THE CONDOR

Volume 57 March-April, 1955 Number 2

JOURNAL OF THE COOPER ORNITHOLOGICAL SOCIETY

THE CONDOR

JOURNAL OF THE COOPER ORNITHOLOGICAL SOCIETY

Published bi-monthly at Berkeley, California. Entered as second-class matter at the post office at Berkeley, California, May 15, 1925, under Act of Congress of March 3, 1879. Issued from the office of THE CONDOR, Museum of Vertebrate Zoology, Berkeley 4, California.

MANUSCRIPTS

Send manuscripts for publication to the Editor, ALDEN H. MILLER, Museum of Vertebrate Zoology, Berkeley 4, California, or to the Associate Editor, FRANK A. PITELKA, same address. Refer to suggestions on preparation of manuscripts for THE CONDOR on the back cover of recent issues of the journal.

SUBSCRIPTION RATES

Subscription price to non-members, five dollars per volume, payable in advance. Single copies, one dollar each.

MEMBERSHIP DUES

Active members, four dollars per year in the United States, of which $3.00 is for a year's subscription to The Condor; four dollars and twenty-five cents per year in all other countries in the International Postal Union.

Sustaining members, five dollars per year.

The life membership fee is one hundred dollars. No additional dues are required. The money is invested and the interest only is used for Society publications. Life members receive THE CONDOR without additional charge. Concerning memberships, address C. V. DUFF, 1922 Tamarind Ave., Hollywood 28, Calif.

Send dues, subscriptions and notices of change of address to JACK C. VON BLOEKER, JR., 161 West 121st St., Los Angeles 61, California.

Send orders for back numbers of THE CONDOR and the PACIFIC COAST AVIFAUNA series to THOMAS R. HOWELL, Department of Zoology, University of California, Los Angeles 24, California.

Issued March 30, 1955

CONTENTS

		PAGE
Observations on Mexican Birds	*Dean Amadon* and *Don R. Eckelberry*	65
Determinate Laying in Barn Swallows and Black-billed Magpies	*David E. Davis*	81
Winter Society of the Oregon Junco: The Flock	*Winifred S. Sabine*	88
The Natural Termination of the Refractory Period in the White-crowned Sparrow	*Donald S. Farner* and *L. R. Mewaldt*	112
Avian Mortality from DDT in Californian Rice Fields	*Robert L. Rudd* and *Richard E. Genelly*	117
FROM FIELD AND STUDY		
Calliope Hummingbird Entangled in Grass Barbs	*Harold M. Tucker*	119
Glossy Ibis in Oklahoma	*George Miksch Sutton*	119
A Winter-active Poor-will	*Norman H. Mellor*	120
Some Recent Arizona Bird Records	*Robert W. Dickerman*	120
Black Scoters Reported from Baja California	*Carl L. Hubbs*	121
Taxonomic Comment on Races of Leach Petrel of the Pacific Coast	*W. E. Clyde Todd*	122
Nesting of European Starling in Western Montana	*John L. Blackford*	122
Another Blue-footed Booby in Southern California	*Alma Stultz*	123
Great Swallow-tailed Swift in Michoacán, México	*Robert K. Selander*	123
The Nighthawks of the Tamaulipas Coast of México	*Richard R. Graber*	125
NOTES AND NEWS		126
PUBLICATIONS REVIEWED		127
COOPER SOCIETY MEETINGS		127

CINNAMON-TAILED SPARROW
Aimophila sumichrasti
Natural size
Painting by Don R. Eckelberry

THE CONDOR

VOLUME 57 MARCH-APRIL, 1955 NUMBER 2

OBSERVATIONS ON MEXICAN BIRDS

By DEAN AMADON and DON R. ECKELBERRY

On April 15, 1952, Edward Chalif, Roger Hurd, Bertram Schaughency, and the authors entered México at Matamoros, Tamaulipas, to initiate about seven weeks of field work in the eastern and southern sections of that country. After reaching the Pan-American Highway we followed it to Pachuca where we turned east to Tecolutla and Nautla on the Gulf coast. From Nautla we proceeded inland to Tezuitlán, Perote, and Jalapa, reaching the coast again at Veracruz City, and from there we went southeast to Coatzacoalcos and Tonalá by way of Alvarado, San Andrés Tuxtla, and Acayucan. Crossing the Isthmus of Tehuantepec, we rejoined the Pan-American Highway and followed it east to Tuxtla Gutiérrez, Chiapas. From this point a side trip was made to Pueblo Nuevo, about 30 miles north-northeast of Tuxtla. From Tuxtla we took the highway west to Tehuantepec and Oaxaca City, turning off at Izúcar de Matamoros to reach our camp on Popocatepetl by way of Cuautla. Hurd left the expedition at Tehuantepec and Chalif at Popocatepetl. Schaughency and the authors returned via México City and the highway, arriving in Brownsville, Texas, on June 5. No overall list was compiled, but Eckelberry's notes cover 415 species. Camps were made in 27 areas. Forms collected are marked with an asterisk. Localities referred to in the annotated list which require general comment are as follows:

Veracruz: Seventeen miles south of Veracruz City.—This is an area of coastal prairie which was extremely dry at the season we visited it. Overgrazed grassland predominates, although low trees and dense shrubs border the water courses, which for the most part were reduced to scattered pot holes. Our camp was near a muddy, open pond beside the road, which we called Yellow Finch Pond because of the constant presence there of this finch (see annotated list). The ponds and pot holes were also a strong attraction to such species as Caracaras (*Polyborus cheriway*), Fork-tailed and Scissor-tailed flycatchers (*Muscivora tyrannus* and *M. forficata*), Vermilion Flycatchers (*Pyrocephalus rubinus*), Brown-headed and Bronzed cowbirds (*Molothrus ater* and *Tangavius aeneus*), which were joined by one Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*), Rough-winged, Bank, Mangrove, and Barn swallows (*Stelgidopteryx ruficollis, Riparia riparia, Iridoprocne albinea, Hirundo rustica*), Mourning, Common Ground, Ruddy Ground, and Inca doves (*Zenaidura macroura, Columbigallina passerina, C. talpacoti, Scardafella inca*), as well as others mentioned in the annotated list.

Veracruz: Tacolapan.—This small settlement on the Río Tacolapan at the base of the Tuxtla Mountains is not shown on any of our maps, but we were advised by the local people that it is some 20 kilometers from Tlacotalpan. It may be the "Tecolapan" referred to by Wetmore (1943:225). At any rate the typical humid lower tropical jungle found here is adequately described in that paper, including mention of the choncha palm. We were greatly surprised not to see or hear a single parrot in the area, but birds were abundant and mention of even the most common species would be prohibitively long.

Veracruz-Oaxaca: Rio Jaltepec, Isthmus of Tehuantepec.—This point at which the

Río Jaltepec, a tributary of the Río Coatzacoalcos, intersects the trans-isthmian road is at the border of the states of Oaxaca and Veracruz. There is no extensive forest here, the land being largely under cultivation, but open forest with considerable brushy undergrowth borders the north side of the river and becomes quite dense in a low, wet area less than a mile to the west. The south or Oaxacan side is almost completely cleared except for small trees and scrub on a grassy flat east of the bridge. Eckelberry listed 100 species in a two and one-half day period.

Oaxaca: Fifteen miles east of Tehuantepec City.—The vegetation of this arid lower tropical area was composed largely of organ pipe cacti, acacias, and other brushy growth. A morning's work produced 25 species. The only Lesser Ground-Cuckoo (*Morococcyx erythropygus*) that we encountered was seen here. Green Parakeets (*Aratinga holochlora*) were abundant, Lesser Nighthawks (*Chordeiles acutipennis*) were common, and Orange-breasted Buntings (*Passerina leclancherii*) were seen mating.

Chiapas: Mountains near Pueblo Nuevo.—This is a beautiful area at about 5300 feet, sharply divided between pine-oak woods and cloud forest. The pines support bromelaids and other epiphytes. The trees of the higher cloud forest are not particularly large and are so completely covered with mosses, ferns, bromeliads, philodendrons and other plants that it is difficult to determine what foliage belongs to the trees. The ground is covered with bracken-like ferns and many other plants, some of intermediate height such as a large spine-covered tree-fern. Entering this dark and wet forest from a milpa was almost like going into a cave. Movement and observation were extremely difficult and few birds were seen. There were heavy rains, as the natives put it, *todos tardes*.

The Band-tailed Pigeon (*Columba fasciata*), White-eared Hummingbird (*Hylocharis leucotis*), Red-shafted Flicker (*Colaptes cafer*), Steller Jay (*Cyanocitta stelleri*; the local race, *ridgwayi,* shows pronounced white "eyebrows"), Brown-backed Solitaire (*Myadestes obscurus*), Red Crossbill (*Loxia curvirostra*) and Red-eyed Towhee (*Pipilo erythrophthalmus*) are common in the pines. The birds of the montane rain forest, like those of the other uplands of Chiapas, have strong Guatemalan affinities, the Quetzal (*Pharomachrus mocino*) being the most conspicuous example.

Mexico: Volcán de Popocatepetl.—Inasmuch as Paynter (1952) has listed 29 species for the Popocatepetl-Ixtaccihuatl area from October 31 through November 5, it may be worth while comparing our list for the western side of Popocatepetl from the valley to timberline, May 27–28. Excluding eight species seen in the valley, 34 were recorded for the volcano. Seventeen species listed by Paynter were not observed by the authors, although three of these were seen in the valley. On the other hand we found the following 16 species not listed by Paynter for the area.

The Tufted Flycatcher (*Mitrephanes phaeocercus*), White-breasted Nuthatch (*Sitta carolinensis*), and Black-headed Grosbeak (*Pheucticus melanocephalus*) were seen in the lower pine forests. In the fir belt at about 10,000 feet we found the Turkey Vulture (*Cathartes aura*), Red-tailed Hawk (*Buteo jamaicensis*), White-naped Swift (*Streptoprocne semicollaris*), Hairy Woodpecker (*Dendrocopos villosus*), Black-eared Bush-tit (*Psaltriparus melanotis*), *White-throated Robin (*Turdus assimilis*), Russet Nightingale-Thrush (*Catharus occidentalis*), and *Slate-throated Redstart (*Myioborus miniatus*). In the highest pines at timberline we found the White-throated Swift (*Aëronautes saxatalis*), Steller Jay (*Cyanocitta stelleri*), Eastern Bluebird (*Sialia sialis*) feeding young in nest, and Pine Siskin (*Spinus pinus*). And slightly lower, at the Pass of Cortés, Eastern Meadowlarks (*Sturnella magna*) were common in the sacaton grass.

Two additional birds, a whip-poor-will (likely *Caprimulgus vociferus*) which was

seen at dusk and voiced only a few phrases, and a swift (*Chaetura vauxi* presumably), which was high-flying and very common, are not included in our total number of species recorded in this area.

Acknowledgments.—We wish to thank Mr. Everts Storms for his generous hospitality to us at Rancho Paño Ayuctle; Sr. Miguel Alvarez del Toro for the pleasure of his company in the field and that of his family in his home, as well as for specimens and helpful information; and the United States National Museum, through Dr. Herbert Friedmann and Mr. Samuel Arny, for the loan of a specimen of one of the rarest swifts in collections. Mr. Paul Martin identified a snake for us, and Mr. William C. Dilger sent us information from unpublished material at Cornell University. For reading and criticizing the manuscript we are indebted to Mr. Eugene Eisenmann and Mr. Byron Harrell. A permit to collect specimens was issued to us through the kind offices of the Departmento de Forestal y de Caza in México City. The expenses of the senior author were met in part by a grant from the Frank M. Chapman Memorial Fund.

NOTES ON MIGRANTS

April 18. Forested foothills near Rancho Paño Ayuctle on the Rio Sabinas, Tamaulipas: One Hooded Warbler (*Wilsonia citrina*) singing frequently and several Common Redstarts (*Setophaga ruticilla*). Neither has been listed heretofore by Sutton and others for the area.

April 28. Lowlands a few miles east of Papantla, Veracruz: Warbling Vireo (*Vireo gilvus*), Bay-breasted Warbler (*Dendroica castanea*), Baltimore Oriole (*Icterus galbula*), Scarlet Tanager (*Piranga olivacea*), a male in full spring plumage, and Summer Tanager (*Piranga rubra*).

April 29. Pine country between Perote and Jalapa, Veracruz: Black-throated Green Warbler (*Dendroica virens*).

May 3. "Yellow Finch Pond," 17 miles south of Veracruz City: Rose-breasted Grosbeak (*Pheucticus ludovicianus*). Between this point and Alvarado we encountered a heavy migration of Scissor-tailed Flycatchers (*Muscivora forficata*) and saw as many as 14 perched on one bush.

May 3. Bay of Alvarado, Veracruz: Ringed Plover (*Charadrius hiaticula*), Thick-billed Plover (*Charadrius wilsonia*). The Mexican Check-list (Friedmann, Griscom, and Moore, 1950) does not list the former for Veracruz and reports only two records for the latter. Unaware of this at the time, we did not count the several birds seen. Sandwich Tern (*Thalasseus sandvicensis*). Only winter records are indicated from Veracruz in the Mexican Check-list. Several were seen with Common and Royal terns and Black Skimmers.

May 4. Tacolapan, base of Tuxtla Mountains, Veracruz: Black-billed Cuckoo (*Coccyzus erythrophthalmus*). We were surprised that on this late date we saw the largest warbler wave both as to species and numbers. They included the Tennessee Warbler (*Vermivora peregrina*), Yellow Warbler (*Dendroica petechia*), Magnolia Warbler (*D. magnolia*), Chestnut-sided Warbler (*D. pensylvanica*), Water-thrush sp.? (*Seiurus*), Hooded Warbler (*Wilsonia citrina*), Pileolated Warbler (*W. pusilla*), Canada Warbler (*W. canadensis*), and Common Redstart (*Setophaga ruticilla*).

May 6. Lake Catemaco, Veracruz: One Pied-billed Grebe (*Podilymbus podiceps*) with a group of 18 Least Grebes (*Podiceps dominicus*). The Mexican Check-list does not list *Podilymbus* for Veracruz.

May 12–14. Rio Jaltepec and trans-isthmian road, Veracruz-Oaxaca border: A Duck Hawk (*Falco peregrinus*) was noticed overhead because of the sudden frenzied screaming of Brown Jays. Four Baird Sandpipers (*Erolia bairdii*) were seen on the south side of the river in Oaxaca where, according to the Mexican Check-list, the species is unrecorded. A single Western Kingbird (*Tyrannus verticalis*) was collected, but an impressive migration of hundreds of Eastern Kingbirds (*T. tyrannus*) literally covered trees, the birds fluttering and chattering in great excitement. Other migrants included the Olive-sided Flycatcher (*Nuttallornis borealis*), Swainson Thrush (*Hylocichla ustulata*), Yellow Warbler (*Dendroica petechia*), Magnolia Warbler (*D. magnolia*) and Pileolated Warbler (*Wilsonia pusilla*).

May 22. Marshes near Tehuantepec, Oaxaca: Black-bellied Tree Ducks (*Dendrocygna autumnalis*), Baldpates (*Mareca americana*) and Shovelers (*Anas clypeata*), for which the Mexican Check-

list does not list Oaxacan records, in company with White Ibises (*Eudocimus albus*), Roseate Spoonbills (*Ajaia ajaja*), Blue-winged Teal (*Anas discors*), and several herons. The date impressed us as late for the northern ducks.

ANNOTATED LIST OF SPECIES

Pelecanus erythrorhynchos. White Pelican. Observed soaring near the coast in Tamaulipas, fifteen or twenty miles south of Brownsville, Texas, both when we entered México on April 15 and when we left on June 5. Since the latter date seems rather late for migrants, the possibility of a nesting colony somewhere on this coast should be considered. So far as we know the only colony on the Gulf coast is the one near Corpus Christi, Texas, more than 100 miles to the north. We also saw a flock of White Pelicans at Tecolutla on the coast of Veracruz on April 28.

Elanoïdes forficatus. Swallow-tailed Kite. Common in the pine forests in Chiapas; not seen elsewhere. Two of these birds were seen harrying a Turkey Vulture, but all three birds soared so gracefully that the small circles they described only now and then brought one of the kites over the vulture. The kite would then bend its head down, dangle its feet, but continue without contact with the vulture or interruption in its movement. While the kites may have been defending a nest nearby, their performance gave the impression of pure aerial play.

**Buteogallus anthracinus anthracinus*. Common Black Hawk. An adult female was taken a few miles west of Río Jaltepec, Oaxaca, on May 14. It is surprising how similar the nominate race of this black hawk is to *B. a. cancrivorus*, of which we examined four skins from the type locality, St. Vincent, Lesser Antilles. There is no difference in size or in the blackness of the plumage, but the light markings on the nape and the margins of the back feathers average buffier in *cancrivorus*. Some specimens from Ecuador and Colombia are smaller and buffier than the Oaxacan bird, but this presumably represents intergradation toward the coastal form, *subtilis*, whose status is still not fully understood. Cursory examination of a good series of *subtilis* suggests that even the adult is much buffier than adults of *cancrivorus* and *anthracinus*, although Dickey and van Rossem (1938:125) and Wetmore (1946:28) considered small size its chief character.

Marshall (1943:22) has reported an immature specimen of *subtilis* from the inland Lake Olomega in El Salvador. He regards it as a straggler from the coast rather than an indication that *subtilis* and *anthracinus* are sympatric species.

Buteogallus gundlachi of Cuba and *B. aequinoctialis* of the coast of Brazil seem, like *subtilis*, to be coastal or mangrove representatives of *anthracinus*, of small size and rufous coloration. *Gundlachi* can perhaps be regarded as a race of *anthracinus* (unless *subtilis* should prove to be a species, in which case similar rank would be indicated for the Cuban form), but *aequinoctialis* is so different that it is no doubt correct to believe that it has achieved specific status.

Amadon (1949) concluded that there is little basis for separating *Hypomorphnus* [*urubitinga*] from *Buteogallus*; on the other hand, the related "eagles" *Harpyhaliaetus coronatus* and *H. solitarius* are so much larger and more robust that generic separation seems indicated. These two birds, which were placed in separate genera (*Harpyhaliaetus coronatus* and *Urubitornis solitaria*) by Peters (1931, 1; 246) and others, were, a few years later, regarded as conspecific by Hellmayr and Conover (1949: 199)! In the absence of any indication whatever of intergradation between these well marked forms, we consider it best to regard them as distinct but congeneric species.

We thus have for this group of related species:

Buteogallus aequinoctialis (Gmelin)
Buteogallus (*?anthracinus*) *gundlachi* (Cabanis)
Buteogallus (*?anthracinus*) *subtilis* (Thayer and Bangs)
Buteogallus anthracinus cancrivorus (Clark)
Buteogallus anthracinus anthracinus (Lichtenstein)
Buteogallus urubitinga (Gmelin)—3 races
Harpyhaliaetus solitarius (Tschudi)
Harpyhaliaetus coronatus (Vieillot)

The form *Buteogallus anthracinus micronyx* van Rossem and Hachisuka, described from Sonora, was not recognized by Friedmann (1950) or other recent workers.

**Busarellus nigricollis nigricollis*. Black-collared Hawk. A non-breeding female was taken on May 2, 17 miles south of Veracruz City. The uniformly broad wings and very short tail of this strik-

Fig. 1 Black and White Hawk-eagle (*Spizastur melanoleucus*).
Drawing by Don R. Eckelberry.

ing hawk create a highly distinctive flight pattern, somewhat like that of the Black Vulture (*Coragyps atratus*), although the effect is rather more eagle-like. Contrary to published statements by Sturgis (1928:135) and others, there is no resemblance to an Osprey. When perched, the wings extend at least to the tip of the tail, if not beyond.

The individual secured was one of two seen at intervals for a half hour or so, soaring over open country. Suddenly it dropped earthward with legs dangling and tail pumping awkwardly up and down. It perched in a low tree beside a weed-choked pond. Later, near Coatzcoalcos, we found two of these hawks beside a lagoon, one in a royal palm, the other lower in mangroves. Shortly, a third circled over and the two others flew up as though to challenge it, uttering rather low-pitched cries.

Spizastur melanoleucus. Black and White Hawk-eagle. On April 17, along the Río Sabinas at Rancho Paño Ayuctle, Eckelberry and Chalif observed a hawk circling overhead not far above the cypresses. It was entirely white below except for frosty barring on the primaries, a barred tail, and black lores. The following day the bird was seen again by the entire party, perched at some distance on the crown of a jungle tree (fig. 1), where it was being scolded by Brown Jays. It appeared rather blackish above. The black crest was short, was held flat, and projected slightly beyond the back of the head. Chalif approached closely and verified these characters. When it took to the air, it appeared more brownish and not unlike an Osprey in general pattern, although quite buteo-like in proportions and manner of flight. After a few flaps it soared in circles, appearing very white headed when its back was toward us, although the dark lores and black crest could be seen. We identified it as *Spizastur melanoleucus*, a species hitherto not reported north of southern Veracruz.

The Ornate Hawk-eagle (*Spizaëtus ornatus*) occurs in this area. It differs from *Spizastur melanoleucus* in being larger and more conspicuously crested, and in lacking the dark lores; and while extensively white below, it shows strong barring on sides, flags, and underwing coverts. Immatures are white-headed. *Ornatus* is more accipiter-like in proportions with a decidedly longer tail. Sutton advises us that "high in air, *S. ornatus* looks rounded winged and very big-tailed, but not especially long-tailed." This was certainly *not* true of the buteo-shaped bird we observed.

The Gray-headed Kite (*Leptodon cayanensis*) in some plumages also resembles *Spizastur*. *Leptodon*, however, is a slighter bird with a relatively longer tail; it lacks the blackish areas before the eyes, and the wing quills are more prominently barred below. Surely it would not have the erect, robust, flat-headed aquiline profile of the bird we saw.

Spizastur melanoleucus and *Spizaëtus ornatus* belong to a group of tropical eagles that have fully booted tarsi. They seem to be fairly closely related to the true eagles of the genus *Aquila*, but they are even more predatory in habits and, unlike the aquilas, are never carrion-feeders. Some of these tropical eagles, and this is especially true of those belonging to the pan-tropical genus *Spizaëtus*, have the proportions of a classical "hawk" (*Accipiter*). For this reason they are known in books on the birds of the Old World as "hawk-eagles." In America this term has unfortunately become transposed into "eagle-hawks." Since uniformity is desirable and since these birds are certainly deserving of the name eagle, we suggest that the form "hawk-eagle" be used uniformly.

**Charadrius collaris*. Collared Plover. A fledgling hardly old enough to fly was taken on May 13, and an adult male on May 14, both from Río Jaltepec, Isthmus of Tehuantepec. The species was quite common and presumably it nested on the numerous gravel bars along the Río Jaltepec, although it is conceivable that the fledgling could have flown in from the coast. Very small chicks were seen with their parents along the Río Grijalva near Tuxtla Gutierrez, Chiapas, on May 20. The Mexican Check-list (Friedmann, Griscom, and Moore, 1950:91) states that *C. collaris* is primarily coastal, but our experience indicates that where suitable gravel bars exist it is at home along large rivers.

Bolborhynchus lineola. Barred Parakeet. On May 18 and 19 near Pueblo Nuevo, Chiapas, small groups (10 or less) of little parrots were often seen flying with great velocity high above the mountain forest, uttering tiny but typically psitticine shrieks. Alvarez del Toro told us these were Barred Parakeets and showed us his specimens. There were only six records for México at the time of the Mexican Check-list (1950:127), one of these from Petalcingo, Chiapas (R. T. Moore Collection).

**Tapera naevia excellens*. Striped Cuckoo. A male was taken on May 2, 17 miles south of Veracruz City; gonads little if any enlarged, but calling freely; gape and base of mandible dull light chrome yellow; outer portion of mandible matched color of margins of adjacent forehead feathers, blending to dull chrome in area under nostril; maxilla light gray-green, the ridge broadly horn black; iris

orange brown, matching color of crown feather margins; eyelids dull chrome yellow; tarsi and feet light blue-gray-green, the claws slightly darker fleshy horn color.

Excellent films of this cuckoo, which were obtained by Mr. Schaughency while it was calling from one of the outer twigs of a leafy bush, show that the crest is raised and lowered rhythmically between each call. The call consists of two somewhat melancholy but deliberately whistled notes, slow but clear and endlessly repeated: *pee-tee, pee-tee,* etc. It was coaxed into the open by our imitating its notes.

Streptoprocne semicollaris. White-naped Swift. On May 27 we were camped just off the road leading to the Pass of Cortes on the shoulder of Popocatepetl, México, at about 10,000 feet in the fir belt. Late in the afternoon Eckelberry and Schaughency were standing near the edge of a ravine just beyond kilometer mark 76, when a compact flock of 15 or 20 large swifts bolted out of the ravine where it narrowed and rose on our right. They shot past at no great distance and somewhat below eye level, chippering loudly. The white nape was seen but, due to the angle, they were at first taken to be the familiar White-collared Swifts (*S. zonaris*). They passed up and down the ravine several times, chippering in pell-mell flight or making a deep *whurr* when gliding on set, backswept wings, before we observed that the white area did not on a single bird extend around the neck to form a collar. They suddenly broke off their dashing flight to soar silently in tight, little circles just above the firs and directly overhead. The wings were then held straight out and presented an interesting

Fig. 2. Silhouette of White-naped Swift (*Streptoprocne semicollaris*).

silhouette (fig. 2). The inner primaries are apparently considerably longer than the secondaries, which produces a pronounced jog at this juncture, giving the wings a peculiar pinched look where they join the body. Soaring birds showed a well spread and ample, *rounded* tail. We did not have an opportunity subsequently to compare this pattern with that of living *zonaris*.

The next morning Eckelbery went up this ravine and found an overhang with a small waterfall nearby. The rock strata were up-ended and the "ceiling" was pocked with many inaccessible holes. A number of white droppings spotted the floor. Amadon later visited this possible nesting site and found a piece of white egg shell. We remained until late afternoon hoping to see the birds again, but without success. It is hoped that by pinpointing this location further investigations will be made. Scarcely ten specimens of this rare Mexican species are known.

The National Museum's loan of its single specimen gave us the opportunity to compare *semicollaris* with a good series of *zonaris*. All specimens of the latter species, even immatures, show at least some white across the throat and chest. The tail of *semicollaris* is square, which would account for the slightly rounded effect when spread, but the slightly forked tail of *zonaris* is sometimes almost square in worn specimens. No satisfactory comparison of the wing shape could be made from specimens.

Momotus mexicanus. Russet-crowned Motmot. A pair was feeding young in a completely exposed hole in a vertical bank only three or four feet high in a vacant field near the Museo Zoológico, Tuxtla Gutiérrez, Chiapas. Mr. Schaughency set up his camera some seventy-five feet away but the birds proved to be so shy that they would not feed the young despite several hours of intermittent waiting. On one occasion a snake, eight inches or so in length, dangled from the bill of one of them, but large insects seemed to be the usual choice. Davis (1953:91) recently reported another instance in which this motmot fed upon snakes. Their wariness was somewhat surprising as the nest was scarcely one hundred feet from a traveled road, and the species impressed us as more adaptable and confiding than *M. momota*. Russet-crowned Motmots were observed on telegraph wires along the highway and in pines and oaks at least to elevations of 4000 feet (fig. 3). The call is a single or double croupy *grook* or *hrook*, guttural and quite unlike the soft, owlish *hoot-hoot* of *M. momota*.

Fig. 3. Russet-crowned Motmot (*Momotus mexicanus*), × 4/5.
Drawing by Don R. Eckelberry.

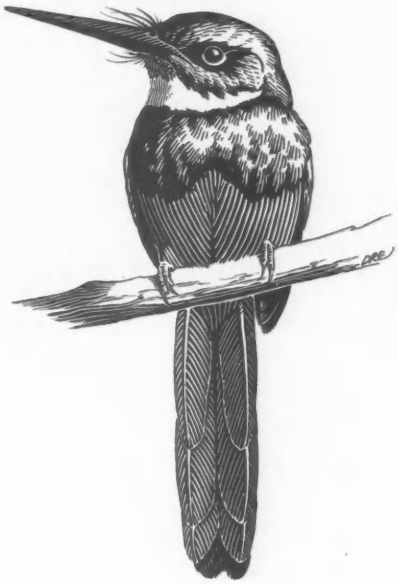

Fig. 4. Rufous-tailed Jacamar (*Galbula ruficauda*), × ½.
Drawing by Don R. Eckelberry.

**Galbula ruficauda melanogenia*. Rufous-tailed Jacamar. A female was taken at the Río Jaltepec, Veracruz, on May 12; bill black; tarsi and feet buffy ochre, slightly lighter than breast; claws black; iris very deep brown, almost black; skin around eye dull green gray which blends with feathers (gold green), brightening to chrome yellow on lower lid.

The ovary of this specimen was rather small. Shortly after the female was collected, a male appeared and we found that the pair had a nest in a bank beside the trail, so well concealed under brush that it would have been impossible to find but for the male's extreme tameness and regular visits to the burrow. It had a favorite perch nearby (see fig. 4) from which frequent sorties were made after dragonflies and other large insects. After beating them against the branch, removing the wings and softening the bodies in its bill, they were taken to the young without hesitation, even while the photographer and two other members of the party surrounded the nest. In flight the male frequently gave a single squeak or an energetic nasal *peet, peet-peet-peet, peet*. A second pair was located about half a mile distant along the same trail in open forest paralleling the river.

**Melanerpes hypopolius*. Gray-breasted Woodpecker. An adult male was taken on May 26, with well developed brood patch. The species nested commonly in large cacti along the Pan-American Highway near Izúcarde Matamoros, Puebla. Several well-fledged young were following their parents about, begging food.

Peters (1948:161) considered the various races of Gila Woodpeckers (*uropygialis*) races of *hypopolius*, but Sutton (1951*a*:220) wrote as follows: "The Gila Woodpecker and its allies are puzzling too. Peters lists eight races, all Mexican or partly so. To me the most southward ranging of these, *hypopolius* (Gray-breasted Woodpecker) seems to be a separate species, if for no other reason than that it has a partly concealed patch of red under the eye." *Hypopolius* is best left a species unless intergradation with *uropygialis* is demonstrated.

Peters (*op. cit.*:157) reduced *Centurus* to a synonym of *Melanerpes*. A number of recent authors, including Sutton, have failed to follow him in this. Yet the barred immature plumage of the Red-headed Woodpecker (*M. erythrocephalus*) and the color pattern of *M. portoricensis*, do tie the two groups together.

Tripsurus pucherani. Black-cheeked Woodpecker. A pair was nesting in a dead tree in an exposed location beside the highway at Tacolapan, Veracruz, on May 5. Masked Tityras (*Tityra semifasciata*) had a nest hole a few feet higher in the same tree.

**Pteroglossus torquatus torquatus*. Collared Aracari. A male was taken on May 6 at the Río Tacolapan, Veracruz; well developed brood patch; base of bill ivory (cream white), mandible otherwise entirely black; tip, top ridge, and marks along serrations of cutting edge of maxilla black; black tip shades through plumbeous to ivory (sharply defined elsewhere); maxilla with large spot bruised purplish flesh shading through green-ivory to ivory; base of inside of bill bright orange, larger and brighter on maxilla and on mandible shading into dusky orange and coming forward as a line into black area; tarsi and feet dull pea green; soles grayed light ochre; claws and sides of toes horn or dusky; iris sulphur or chrome yellow; face skin black concentrically around eye, changing abruptly to carmine red; flesh inside throat orange. The tail was extremely abraded, presumably through contact with the edge of the nest cavity.

**Ramphastos sulfuratus sulfuratus*. Keel-billed Toucan. A female was taken on the Río Tacolapan, Veracruz, on May 6; brood patch present; terminal third of bill deep cherry red or maroon, a straight orange center spot joining maroon on lower part of maxilla; light middle-value gray markings on cutting edges of bill; bill black entirely around base; rest of bill same value as breast but lime yellow fading to banana yellow on ridge and to lighter green-blue at base of maxilla adjacent to cutting edge between the orange area and black base, and on mandible adjacent to maroon tip and along cutting edge to middle of bill and along bottom edge of mandible, except in middle of the light area where somewhat invaded by lime yellow; tarsi and feet: green blue (turquoise), the top scales bluer; leg slightly lighter below and less blue (greener), this light green invading upper scales near heel; soles of feet dirty ochre; claws horn color; iris bright emerald green graduating to darker dull brown around pupil so that definition of pupil is lost; face skin generally matches throat feathers but greener around eye and more yellow-orange adjacent to black cap above and behind eye.

The bright colors of the bill extend even to the inside edges of the "mouth." Since some species of toucans that live together differ externally only or chiefly in the colors of the bills (for example, the present species and R. swainsonii on Barro Colorado Island and elsewhere), it is possible that the function of the bill, insofar as its color and pattern are concerned, is for species recognition, and perhaps as an intraspecific threat organ. The fact that Van Tyne (1929:19) and others have described "dueling" and "sham battles" between toucans in which only the bills are employed, with no attempt made to strike the body, strengthens this hypothesis.

**Myiozetetes similis texensis*. Vermilion-crowned or Social Flycatcher. A male was taken on May 1, 17 miles south of Veracruz City; gonads greatly enlarged. This specimen has conspicuous white tips about a centimeter long on the tail feathers. The red crown patch and the development of the gonads show that it was mature, but the rectrices are somewhat pointed and there is a slight tinge of rusty on the upper tail coverts, suggesting immaturity. Eckelberry was of the opinion that this individual, unlike others of the species in the vicinity, did not have a territory. Probably it is abnormal as regards the tail, for we have seen no other specimen with similar whitish tips.

In the areas visited, the Vermilion-crowned Flycatcher usually nests in bull's horn acacias, often in company with the Kiskadee (*Pitangus sulphuratus*), which builds a similar domed nest with a side entrance. On May 14, just south of the continental divide on the Isthmus of Tehuantepec, we found a nest of *Myiozetetes* with four eggs, about five feet above the ground in a small acacia. One of the birds was on the nest at 11 p.m. and permitted itself to be stroked without leaving the nest.

**Pitangus sulphuratus texanus*. Kiskadee or Derby Flycatcher. A completed nest contained as yet no eggs on May 2, 17 miles south of Veracruz City.

**Myiarchus tuberculifer lawrenceii*. Dusky-capped or Querulous Flycatcher. A male in breeding condition was taken on May 12 at the Río Jaltepec, Isthmus of Tehuantepec. The small size of this specimen (wing 82 mm.) might suggest that it belongs with the race *"connectens"* Miller and Griscom, described from the lowlands of Guatemala. These authorities thought that the break in size occurs south of the Isthmus, and to be sure this specimen does fall within the lower limits of the size

range they give for *lawrenceii* of México. Later, Griscom found that birds from higher altitudes in Guatemala are larger, and called them *lawrenceii*. Admitting that birds from the northern and the higher parts of the range formerly assigned to *lawrenceii* are larger, the problem remains: is it worthwhile upholding the name *connectens* for the smaller birds of the southern lowlands, which have no other basis for their separation? We do not think that it is. Zimmer (1953) has recently discussed the Middle American races of this species and described a new one, *littoralis*, from El Zapotal, Guanacaste, Costa Rica.

**Elaenia flavogaster subpagana*. Yellow-bellied Elaenia. A male taken on May 14 on the Río Jaltepec was one of a pair with a nest almost completed. The nest, which was about 12 feet high in the fork of a thorny bush, was an open, rather shallow cup of grass and weed stems with a layer of lichens attached by (? plant) gauze on the outside and to a lesser extent on the inside. Its overall diameter was 9 cm. The area was a grassy river-side flat grown up here and there with clumps of low bushes and trees. In this flycatcher the whitish bases of the crest feathers are frequently visible in the field.

Fig. 5. Common Tody Flycatcher (*Todirostrum cinereum*), × ¾. Drawing by Don R. Eckelberry.

Todirostrum cinereum. Common Tody Flycatcher. On May 14 along the Río Jaltepec, a pair was found building a nest, a pendant structure 8 or 10 inches long in an early stage of construction. It was situated in a low and rather open bush on the river bank about four feet from the ground. The birds proceeded with their work entirely unconcerned by our presence. On the basis of posture and actions the species is remarkably gnatcatcher-like, even to the tail wagging (fig. 5). In the field it is difficult to think of it as a flycatcher at all.

**Petrochelidon fulva* subsp. Cave Swallow. A male taken at Tuxtla Gutiérrez, Chiapas, was presented to us by Sr. Alvarez del Toro. It seems to have the small size and dark upper parts of the race *citata* from Yucatán, but the sides of the head are pale as in *pallida* from north-central México and Kerrville, Texas. On May 17 we found a colony constructing nests on the beams beneath a portico along the village plaza in the town of Chiapa de Corzo, a few miles from Tuxtla. Three days later we saw this species gathering mud at a bar in the middle of the turbid Río Grijalva. The species also

nests, according to Alvarez del Toro, on the cathedral in Tuxtla. *Petrochelidon fulva* is not listed from this part of México by recent authorities such as Blake (1953).

Notiochelidon pileata. Black-capped Swallow. Formerly considered a genus endemic to Guatemala, the Black-capped Swallow has now been found in El Salvador and Chiapas. We first found these swallows flying about a rock outcropping above Pueblo Nuevo, Chiapas, on May 18, and we saw them again some miles below the village the following day. Both groups were entering and leaving holes in road-cuts. Presumably they were nesting or preparing to nest. Rough-wings (*Stelgidopteryx ruficollis*) were frequenting holes in the same banks. Marshall (1943:31) has described the flight and call note of *Notiochelidon*, of which he found hundreds consorting in a large dead tree on a ridge in El Salvador in March. Wetmore (1941:555) was given specimens on November 26 which were said to be from a group of 30 sleeping in a single hole in a bank in Guatemala. According to Griscom (1932:284) this species also nests in caves, and around buildings.

**Calocitta formosa formosa*. Magpie-jay. A male, collected on May 22 near Tehuantepec, Oaxaca, had a brood patch and was in very worn plumage. The note was a husky *haaah* or *zaaah*, somewhat raven-like but buzzier. Like Brown Jays they moved about in groups.

A specimen was marked by Amadon as a male with well developed brood patch, in ignorance of the supposed absence of this feature in Oscines (Bailey, 1952). But Mewaldt (1952) found a brood patch of common occurrence in males of the Clark Nutcracker (*Nucifraga columbiana*), so it may occur also in other corvids.

Psilorhinus "mexicanus." "White-tipped" Brown Jay. We recorded this form in palmetto hammocks a few miles south of Veracruz City, and also along the Río Jaltepec on the Isthmus of Tehuantepec. In both localities the plain tailed Brown Jay (*P. morio*) was present in greater numbers. Even Wetmore (1943:297), who has been the principal recent advocate of the view that this form is specifically distinct from *P. morio*, states that the two consort together in the same flocks. He was not able to find any difference between them other than the white tips on the rectrices in *mexicanus*. We feel that the conservative course is to regard the white-tipped birds as a phase or mutant of *Psilorhinus morio* until or unless someone can prove otherwise.

**Cyanocorax yncas luxuosa*. Green Jay. A female was taken on May 6 at the Río Tacolopan, Veracruz; brood patch; eye yellow. The two common calls noted were a jay-like *kyit yit yit yit* and one we described as *kyomp-iomp*. The first we took to be a scolding note, whereas the second was closer to the musical "pump-handle notes" of the Blue Jay (*Cyanocitta cristata*).

**Melanotis hypoleucus*. Blue and White Mockingbird. A female was taken on May 18 in oak-pine forest at four or five thousand feet, near Pueblo Nuevo, Chiapas. This individual was very responsive to squeaking and approached through second growth, perching at about 20 feet elevation. Others were seen nearer the ground. They were not uncommon.

Formerly thought to be restricted to Guatemala, this mockingbird was recorded from Chiapas by Wetmore (1941:562). Hellmayr considered *hypoleucus* a race of the Blue Mockingbird (*M. melanotis*). The two differ in little but color. That difference is, however, striking, and there is no doubt that they, like so many other forms, were long isolated, one in México, the other in the highlands of Guatemala and Chiapas. Perhaps the two forms are best left as species. Certainly the fact that the race of *melanotis* found on the Tres Marias Islands has some albinotic individuals with scattered white feathers is no real evidence for uniting them, although Hellmayr used this argument. Both Sutton (1951) and Wetmore (*loc. cit.*) believe that *melanotis* and *hypoleucus* should be granted specific status. The latter described the song of the Blue and White Mockingbird as thrasher-like, with some of the notes in couplets. We noted that it was rather flute-like with a burr, with some thrasher-like notes and not nearly so varied and continuous as that of true mockingbirds.

**Turdus infuscatus*. Black Robin. A male taken on May 18 at Pueblo Nuevo, Chiapas, in cloud forest was in breeding condition; bill, legs, and narrow bare skin around eyes golden ochre (chrome yellow with ochre added); claws very slightly lighter horn yellow; iris: dark red brown.

As Hellmayr (1934:414) has suggested, this bird is closely allied to *Turdus serranus*. No representative is found in the almost 1000 miles from El Salvador, the southern outpost of *infuscatus* to the subtropical zone of Colombia, where *serranus* first appears, unless, as Griscom believes, the duller colored *Turdus nigrescens* of Costa Rica and Panamá belongs here too. It is possible that *serranus* and *infuscatus* are conspecific, as Ripley (1952:45) has considered them to be.

**Turdus rufitorques*. Rufous-collared Robin. A female was taken on May 18 in the pine country

of Chiapas, where the species is very common. Hellmayr (1934:354) wrote: "This is a near relative and possibly merely a strongly marked race of the American Robin (*T. migratorius*), which it is said to resemble in manners and song." The difference in coloration is so great that one hesitates to make *rufitorques* a race of *migratorius*, more especially since there are "robins" in many parts of the world, including South Africa, which look more like *migratorius* that does *rufitorques*. The song of *rufitorques* is somewhat less vigorous than that of *migratorius*, but the call notes are almost exactly the same. It spends more time on the ground than does *T. grayi* or *T. affinis* and in this, too, it resembles *migratorius*.

**Turdus assimilis assimilis*. White-throated Robin. The following specimens were taken: two at about 5000 feet, near Xilitla, San Luis Potosí, April 22; one at Río Tacolapan, Veracruz; one at about 10,000 feet on Volcán de Popocatepetl, México, May 27; all were in breeding condition.

Fig. 6. Rufous-browed Pepper-shrike (*Cyclarhis gujanensis*), × ⅔.
Drawing by Don R. Eckelberry.

The bird taken on Popocatepetl was labeled as a male with well developed brood patch. Since, as in *Calocitta* mentioned earlier, we did not know that this feature is usually absent in songbirds, confirmation of its presence in *Turdus* is required.

Hellmayr refers to the race *Turdus assimilis renominatus* Griscom and Miller of western México as "rather poor" and not discernible in worn plumage. In series, however, western birds seem quite noticeably paler below than nominate *assimilis*, of which we have a nice topotypical series taken by Chapman at Jalapa, Veracruz.

**Tanagra elegantissima*. Blue-hooded Euphonia. A male taken from a mistletoe clump in the high country of Chiapas was preserved in the flesh to aid in investigating Sutton's (1951) suggestion that the euphonias may not be tanagers (Thraupidae), as universally believed, but flowerpeckers (Dicaeidae), related to the Oriental and Australian genus *Dicaeum*. Flowerpeckers and euphonias are both small, short-tailed, nine-primaried birds that live largely on mistletoe berries. In both genera the alimentary canal is modified to accommodate this diet. In the euphonias the gut has become almost a single straight tube with the stomach represented only by a thin-walled slightly enlarged area (Wetmore, 1914). The birds swallow the mistletoe berries whole and derive nourishment from the viscid material which surrounds the seeds. The latter pass through the bird unimpaired and retain enough of their stickiness to adhere to the twigs of trees where, when conditions are favorable, they germinate.

In the genus *Dicaeum* the modification of the alimentary canal is somewhat different and the diet does not consist exclusively of these berries. The "gizzard" or ventriculus has become a blind sac guarded by a sphincter muscle. Mistletoe berries pass to the intestine without entering this diverticulum. But tiny spiders and insects, which are eaten in abundance, do enter the gizzard for partial digestion. In addition to these items of diet, many flowerpeckers feed on nectar and have tubular tongues for doing so (Mayr and Amadon, 1947). The tongue of *Tanagra elegantissima* is small, rather fleshy, and though it has a rather deep depression is by no means tubular. It may be adapted to aid in the speedy ingestion of mistletoe berries.

The intestinal adaptations of *Dicaeum* and *Tanagra* for accommodating mistletoe berries, as just noted, have basic differences. We are inclined to think that parallelism only is involved. Further, certain genera of tanagers such as *Chlorophonia, Tangara* (*Calliste*) and others seem related to the euphonias and connect them with the more typical tanagers. It must be noted, however, that the euphonias build a domed nest with side entrance presumably more or less similar to the hanging domed nest of the flowerpeckers. Further studies of the anatomy and natural history of the euphonias are desirable, but it seems reasonably sure that they are, in fact, tanagers.

**Sicalis luteola chrysops*. Yellow Finch. Two males and one female were taken on May 1 and 2, 17 miles south of Veracruz City; bill dark horn, slightly lighter fleshy horn on lower part of mandible, darkest on ridge of maxilla; tarsi and feet dull fleshy horn, slightly darker on top, the legs of one specimen as dark horn as bill, the others slightly lighter; iris deep brown (appears black).

Small flocks of restless Yellow Finches were constantly pitching in to the edge of the pond where they drank and also probably picked up gravel and perhaps food. Often they would perch in the dead limbs of bushes one hundred feet or so away. We were never able to count more than 23 at any one time, but to say there were twice that number in the immediate area is probably conservative. The call note, a thin *t'slip* given especially while in flight, is somewhat like that of the Horned Lark (*Eremophila alpestris*). Although the gonads, especially of the males, were considerably enlarged, the finches showed no indication of nesting and no song was heard. Perhaps nesting awaited the arrival of the rains, then overdue.

The pond by the road was beside a brush-lined stream reduced at that time to scattered, stagnant pools. Yellow Finches were seen to visit one of these ponds that was clear of vegetation on one side, but in much smaller numbers than at the completely exposed pond by the road.

The Yellow Finch is a very local bird, at least in the Middle American part of its range. Wetmore did not encounter it in his work in southern Veracruz, but Loetscher (1941) found it to be "positively abundant" in a restricted area near Isla. Davis (1952) has previously recorded the species in the area where we found it. Brodkorb (1943) described a race *mexicana* from Morelos based on a considerable series, but his specimens are the only record we know of from western México. The western race is said to be larger and paler than *chrysops*. Hellmayr (1938:327, footnote) stated that *chrysops* itself is scarcely separable from nominate *luteola* of northern South America. Our two adult males of *chrysops* have the top of the head yellower than in any specimens we have seen of *luteola*. The female has the breast yellower and less washed with dusky than in *luteola*, if one may draw valid conclusions from a single specimen.

**Aimophila sumichrasti*. Cinnamon-tailed or Sumichrast Sparrow. One adult male, with testes somewhat enlarged, was taken on May 22 near Tehuantepec, Oaxaca. The species was abundant in the hot, dry brush along the Pan-American Highway about 15 miles east of Tehuantepec City (see color plate). A sprightly tinkling song heard on all sides was attributed to this species, but possibly could have originated from some other sparrow. Two birds were observed perched close together and singing a "whisper song" in duet. Sutton (1952:256) states that *A. humeralis* also has the habit of singing in duet.

Hellmayr's (1938:522) suggestion that *sumichrasti* may eventually prove to be a race of *A. carpalis* of northwestern México, a bird half its size and with some differences in coloration, should not be taken too seriously.

Arremonops rufivirgatus. Olive Sparrow. On April 15, about 30 miles south of Brownsville, Texas, in Tamaulipas, we were attracted by a protesting pair of Olive Sparrows. A coachwhip snake, *Coluber* (*Masticophis*) *flagellum*, was found with its head in the sparrows' nest, which was about three feet above the ground in the center of a large mass of candelabra cactus. The young (or eggs) had been eaten. This was shortly after noon on a hot, sunny day.

LITERATURE CITED

Alvarez del Toro, M.
1952. Los animales silvestres de Chiapas (Tuxtla Gutierrez, Chiapas).

Amadon, D.
1944. The genera of Corvidae and their relationships. Amer. Mus. Novit. No. 1251:1–21.
1949. Notes on *Harpyhaliaetus*. Auk, 66:53–56.

Bailey, R. E.
1952. The incubation patch of passerine birds. Condor, 54:121–136.

Blake, E. R.
1953. Birds of Mexico (University of Chicago Press).

Brodkorb, P.
1943. Two new birds from Morelos, Mexico. Jour. Wash. Acad. Sci., 33:33–34.

Davis, J.
1953. Birds of the Tzitzio Region, Michoacán, México. Condor, 55:90–98.

Davis, I.
1952. Coastal prairie (breeding census). Audubon Field Notes, 6:324.

Friedmann, H.
1950. The birds of North and Middle America. Part II. Bull. U.S. Nat. Mus., 50:xiii + 793 pp.

Friedmann, H., Griscom, L., and Moore, R. T.
1950. Distributional check-list of the birds of Mexico. Part I. Pac. Coast Avif. No. 29:1–202.

Griscom, L.
1932. The distribution of bird-life in Guatemala. Bull. Amer. Mus. Nat. Hist., 64:1–439.

Hellmayr, C.
1934, 1938. Catalogue of birds of the Americas. Pts. 7, 11 (Chicago, Field Museum of Natural History).

Hellmayr, C., and Conover, H. B.
1949. Catalogue of birds of the Americas. Pt. 1, no. 4 (Chicago, Field Museum of Natural History).

Loetscher, F. W., Jr.
1941. Ornithology of the Mexican state of Veracruz. Unpublished thesis (Ithaca, Cornell Univ.).

Marshall, J. T., Jr.
1943. Additional information concerning the birds of El Salvador. Condor, 45:21–23.

Mayr, E., and Amadon, D.
1947. A review of the Dicaeidae. Amer. Mus. Novit. No. 1360:1–32.
1951. A classification of Recent birds. Amer. Mus. Novit. No. 1496:1–42.

Mewaldt, L. R.
1952. The incubation patch of the Clark nutcracker. Condor, 54:361.

Paynter, R. A., Jr.
1952. Birds from Popocatépetl and Ixtaccíhuatl, México. Auk, 69:293–301.

Peters, J. L.
1931, 1948. Check-list of birds of the world. Vols. 1, 6 (Cambridge, Harvard University Press).

Ripley, S. D.
1952. The thrushes. Postilla, no. 13:1–48.

Sturgis, B. B.
1928. Field book of birds of the Panama Canal Zone (New York, G. P. Putnam's Sons).

Sutton, G. M.
1951*a*. Mexican birds—first impressions (Norman, University of Oklahoma Press).
1951*b*. Mistletoe dispersal by birds. Wilson Bull., 63:235–237.

Sutton, G. M., and Pettingill, O. S., Jr.
1942. Birds of the Gomez Farias region, southwestern Tamaulipas. Auk, 59:1–34.

Van Tyne, J.
1929. The life history of the toucan, *Ramphastos brevicarinatus*. Univ. Mich. Mus. Zool., Misc. Publ., 19:1–43.

Wetmore, A.
1914. The development of the stomach in the euphonias. Auk, 31:458–461.
1941. Notes on birds of the Guatemalan Highlands. Proc. U.S. Nat. Mus., 89:523–581.
1943. The birds of southern Veracruz, Mexico. Proc. U.S. Nat. Mus., 93:215–340.
1946. The birds of San José and Pedro Gonzáles Islands, Republic of Panamá. Smithsonian Misc. Coll., 106:1–60.

Zimmer, J. T.
1952. Notes on Tyrant Flycatchers. Amer. Mus. Novit. No. 1605:1–16.

American Museum of Natural History, New York, June 30, 1954.

DETERMINATE LAYING IN BARN SWALLOWS AND BLACK-BILLED MAGPIES

By DAVID E. DAVIS

The problem of the mechanisms controlling cessation of laying eggs has intrigued ornithologists for years. Some birds continue to lay eggs even though the eggs are continually removed but other species lay a definite number irrespective of removals. The first type has been called indeterminate (Cole, 1917, 1930) and apparently occurs in gallinaceous birds and some woodpeckers. The second type is called determinate and has been found (Davis, 1942*a*) in Herring Gulls (*Larus argentatus*), which lay three eggs, except in rare instances. But many birds, especially passerines, lay a variable number of eggs, three to five for example, and some of these species may be indeterminate layers. The procedure for testing this hypothesis is to add eggs to the nest and also to remove eggs from the nest. If the species is an indeterminate layer the addition of eggs should result in a reduction of clutch size and the removal should result in an increase. If the species is determinate, the clutch size should not differ significantly from the reference clutches. A species will be considered determinate if during laying the addition of eggs to some nests and the removal of eggs from others both fail to produce a difference between the number of eggs laid consecutively in such nests and the number laid consecutively in an unmolested clutch. Series of eggs with gaps in the daily sequence are assumed to consist of several clutches.

By this standard no species is known to be indeterminate. It is recognized that this standard may be too rigid and that eventually evidence may show that a species may be indeterminate in the sense that removal results in an increased number of eggs but that addition has no effect. However, for the present it seems best to use the more stringent definition. No systematic experiment on chickens is reported in the literature although anecdotes about cessation of laying are common. Craig (1913) contrasts the determinate laying of pigeons with the indeterminate laying of the domestic fowl but does not cite specific experiments.

A likely candidate for indeterminate laying is a species that lays a variable and large number of eggs. Variability may indicate that external stimuli control ovulation. A large number permits more time for experimentation in each clutch.

Barn Swallows (*Hirundo rustica*) were chosen because this species nests colonially in readily accessible places. The particular barn used in this study, from 1952 to 1954, was about 16 miles northwest of Baltimore, Maryland, and was a conventional cowbarn with ample nesting sites on the rafters. The procedure was simply to remove eggs as laid from certain nests and to add them to other nests. Some nests were undisturbed to serve as reference nests. In the "removal" nests the second and subsequent eggs were taken, thus always leaving one egg. To the "addition" nests a number (4–5) of eggs was added on the day the first egg was laid. The reason that the removals and additions were done at the start of laying is that several days are required for the hormonal mechanisms to act upon ovulation; hence manipulations on the next to last day of laying could have no effect on the number of eggs laid.

Data for Black-billed Magpies (*Pica pica*) were obtained by the Montana Fish and Game Commission as part of a study of the control of magpies. The raw data were printed in the Quarterly Report for April–June, 1950. Permission to use these data was generously granted by Mr. Wynn Freeman.

The results of the experiments are given in table 1 for both species. It requires no

elaborate analysis to show that the removal of eggs did not stimulate laying in either species. It is true that in both species less than the normal number of eggs was laid in the nests to which eggs were added, thus suggesting that the addition of eggs inhibited laying. However, a detailed consideration of the record for each nest suggests that loss of eggs or interference by the observer may be responsible for the reduced number. At any rate, without a clear demonstration of a continuation of laying when eggs are removed, these species cannot be called indeterminate.

Table 1

Number of Eggs Laid per Clutch by Barn Swallows and Magpies under Normal and Experimental Conditions

Number of Barn Swallow nests				Number of Magpie nests				
Eggs laid	Normal	Eggs removed	Eggs added	Eggs laid	Normal	All eggs removed daily	1–2 eggs left daily	Eggs added
2	0	1	0	4	0	0	1	1
3	0	1	0	5	0	1	0	3
4	3	4	4	6	2	3	4	3
5	7	5	6	7	14	6	4	2
6	3	4	0	8	6	5	4	1
				9	0	0	1	0
Total nests	13	15	10	Total nests	22	15	14	10
Mean size of clutch	5.0	4.7	4.6	Mean size of clutch	7.2	7.0	6.9	5.9
Standard deviation	0.67	1.21	0.63	Standard deviation	0.58	1.07		1.14

Since these species are determinate layers, the variability in clutch size found must be explained by appealing to varying physiological conditions due to age, nutrition, temperature, or other factors. For Barn Swallows in this particular cowbarn, the clutch-size for 80 normal clutches (1949 to 1953) averaged 4.64 (standard deviation = 1.00) with a range of 2 to 6. While possibly the 2- and 3-egg clutches had lost some eggs, there were 15 4-egg clutches, 42 5-egg clutches and 12 6-egg clutches. This variation may be considered normal. In other barns near Baltimore, 45 nests averaged 4.55 eggs (standard deviation = .76).

It seems desirable to bring together as many data as possible concerning the topic of determinate laying, for the literature is widely scattered and often located in old or obscure journals. Some data were presented in tabular form by Laven (1940*b*). The papers mentioned by Laven have been checked in the original (except Altum, 1869, and Eisenhut and Lutz, 1936). Unfortunately, Laven did not clearly distinguish between laying of eggs daily and laying of several clutches in the same nest.

Apparently some species may be shown to be indeterminate. The Yellow-shafted Flicker (*Colaptes auratus*) may actually lay up to 71 eggs (Phillips, 1887) consecutively. Burns (1900) compiled a list of seven cases in which the eggs were taken daily and the total number of eggs laid varied from 17 to 71. Burns also listed 11 cases in which the eggs were collected in sets; these varied from 15 to 48 eggs per nest. For the Wryneck (*Jynx torquilla*), Alderson (1897) reported a case of 62 eggs laid consecutively, Warga (1925) reported 33, and Hanke (see Jull, 1940), reported 48. Witschi (1935) reported that House Sparrows (*Passer domesticus*) laid up to 50 eggs, in some

cases 12 to 19 being consecutive. Puhlman (1914) did not state clearly that he removed eggs consecutively but found that *Passer domesticus* and *Passer montanus* never went above twice the "clutch-size." Kreymborg (1911) found 16 eggs in a House Sparrow nest but no proof of consecutive laying. Bisshop (1923) reported a sparrow that laid 29 eggs in 7 clutches and Wenzel (see Jull, 1940) got 51 eggs from a sparrow. Roberts (1940*b*) stated that the Gentoo Penguin (*Pygoscelis papua*) can replace eggs that are taken from the nest, but he gave no data. Gwynn (1953) found that the Gentoo Penguin laid a third egg in 4 out of 8 cases when the 2 eggs were removed as laid. Also, when only the first egg was removed, 2 more eggs were laid in 2 out of 8 cases. But when only the second egg was removed no more eggs were laid in 10 cases. These data suggest that this species is indeterminate. Thus far the species mentioned are the only ones for which data actually suggest indeterminate laying. But in no case was the addition of eggs tried.

In many instances it is clear that several sets were laid in the same nest but usually there is no proof that the same bird laid the various sets. For this type of work banded birds must be used. Burns (1900) quoted C. L. Rawson's observations that in 14 species the seasonal total when eggs were removed as laid was no more than 2 to 4 sets, except a Sharp-shinned Hawk (*Accipiter striatus*) which laid 17 eggs in one nest in 5 sets. Riviere (1897) reported that a Starling (*Sturnus vulgaris*) laid 2 sets with an interval of 5 days between. Kreymborg (1911) reported a magpie laying 20 eggs but said nothing about consecutiveness. Grabham (1897) took 28 eggs from a nest of a Dipper (*Cinclus cinclus*) but said nothing about the details. Miller (1910) took 36 eggs from a Gallinule (*Gallinula chloropus*) nest in 3 visits. Groebbels (1937:243) listed several observations that appear to be consecutive laying of sets rather than continual laying. Burrows (1945:40) quoted a statement in an old book by Jesse that the Long-tailed Tit (*Aegithalos caudatus*) laid 30 eggs in succession as the set was depleted.

Some species have been tested a few times by regular removal. Puhlman (1914) stated that the European Coot (*Fulica atra*) lays only 4 eggs. Bankes (1897) found that a Redshank (*Totanus totanus*) laid 5 clutches of 4 eggs. Roberts (1940*a*) reported that the Wilson Petrel (*Oceanites oceanicus*), and all known procellariiform birds, do not replace their egg after destruction. Laven (1940*a*) found that the Ringed Plover (*Charadrius hiaticula*) laid only 4 when an egg was removed daily. The same was true for *Vanellus vanellus* (Laven, 1940*a*). Nash (1942) found that an Eastern Bluebird (*Sialia sialis*) laid only 5 eggs. A cuckoo (*Guira guira*) mentioned by Farley (1924) probably laid several clutches. Nice (1937) commented that the addition of Cowbird (*Molothrus ater*) eggs to sets of the Song Sparrow (*Melospiza melodia*) did not inhibit the latter from laying the usual complement of eggs. Howell (1942:561) removed eggs from nests of three American Robins (*Turdus migratorius*) without any increase in number laid. He commented that the ovaries of several birds that had laid full clutches contained ova with large yolk. Berndt (1943) merely stated that the addition or removal of eggs from the nest of the Pied Flycatcher (*Muscicapa hypoleuca*) had hardly any effect on the number of eggs laid. A number of miscellaneous experiments have been done by the author over a period of years on five species of passerine birds with no indication of indeterminacy. From this review of the literature it is obvious that very few species have received the detailed study of many nests that is necessary to determine the results in respect to determinacy.

The problem of determinacy naturally arises for the domestic fowl, but no series of experiments has been found reported and consequently a series has been started. Craig (1913) merely stated that hens continue to lay. There are many studies of the time

interval between eggs which show that 24 to 28 hours may separate layings. The number of consecutive days of laying comprises a cycle whose length depends upon the separation of eggs in hours. Birds that have 28 hours between eggs perforce lay only 2 in a cycle because darkness interrupts a sequence, whereas birds with a 24-hour separation may lay as many as 69 (Heywang, 1938). Unfortunately, the cycle is often confused with a clutch. The latter term should be used to refer to the number of eggs laid up to the time of brooding, whether they are laid daily or not. Thus, some passerine birds have been known to miss a day in the laying of a clutch and many non-passerine birds regularly lay at two-day intervals. The number of hours between eggs may be an important aspect in the control of clutch size since in some species the cycle length may determine the clutch size.

Domesticated ducks apparently are similar to domesticated fowls such as chickens and turkeys. An old report (see Jull, 1940:292) states that a wild Mallard lays 80 to 100 eggs if one is removed daily.

Stieve (1918:557) showed that a hen has a series of ova of decreasing size in the ovary while she is laying in contrast to the situation in the Jackdaw (*Corvus monedula*) (Stieve, 1919), which has only a certain number of ova that reach large size.

The problem of determinacy in gulls has been studied by several persons. Salomonsen (1939) reported that Herring Gulls may lay as many as 16 eggs in a season. In some cases 4 eggs were laid consecutively in one nest. Spear (1942) found up to 12 eggs in some nests. Goethe (1937:51) stated that if eggs are added to a gull's nest, it will continue laying even though 5 or 6 eggs are in the nest. Davis (1942*a*) performed apparently the first experiment designed to test the determinacy of laying. He added eggs and removed eggs and found that Herring Gulls laid only 3. Von Torne (1940) reported 5 eggs for one *Larus canus*, which species normally lays 3.

Cowbirds, although social parasites, apparently lay eggs in clutches. Davis (1942*b*) examined the ovaries histologically and found that the old follicles were in chronological groups of 4 or 5. Nice (1949), from her observations on Cowbird eggs in Song Sparrow nests and from Walkinshaw's (1949) data, concluded that Cowbirds lay in clutches. The communistic cuckoos of the subfamily Crotophaginae must be determinate layers (Davis, 1942*c*) because several females lay in one nest but each female lays 5 to 7 eggs.

Lack (1933) called attention to the fact that variations in local conditions may affect the maturing of the eggs in the ovary. Indeed, laying may actually be suspended as was found by Pitt (1929) for *Turdus filaris*, by Timmerman (1932) for *Phylloscopus collybita*, and by Weydemeyer (1934) for Tree Swallows (*Iridoprocne bicolor*). Rowan's (1918) report of apparent suspension may be a case of two birds laying in the same nest. This suspension of laying certainly raises questions about the changes in the ovary during these days.

Frances Hammerstrom kindly permitted the use of some unpublished data on House Wrens (*Troglodytes aëdon*). In 1913 L. J. Cole removed eggs as laid by a wren. This bird laid 13 eggs, rested 4 days, laid 7, rested 4 days, laid 5, rested 5 days, laid 5, and stopped. In a subsequent experiment the addition of 7 eggs on the day that the first egg was laid did not prevent the laying of 7 eggs. Recently Hammerstrom removed eggs daily from the nests of 13 females. The average of 20 clutches was 6.2 eggs (range 4 to 9). Kendeigh (MS) summarizes this work and adds some data of his own. He suggests the interesting possibility that wrens are indeterminate in the early part of the season but not in the late part, because when eggs were removed there were more large clutches (8–9 eggs) in the early part of the season than in the late part. However, the normal seasonal decline in clutch size is perhaps a factor.

SUMMARY

The problem of determinate laying has been investigated for two species that lay a variable number of eggs in the nest: Barn Swallows (*Hirundo rustica*) and Black-billed Magpies (*Pica pica*). A species may be considered an indeterminate layer if the addition of eggs to the nest at the start of laying results in a reduction of clutch size and if the daily removal of eggs results in an increase. For Barn Swallows the normal (unmolested) clutch size was 5.0. Nests from which eggs were removed averaged 4.7 while nests to which eggs were added averaged 4.6. The corresponding values for magpies were 7.2, 7.0 and 5.9. It is concluded that these species are determinate layers.

A thorough review of the literature shows no clear proof that any species is indeterminate by these standards, although flickers, Wrynecks, House Sparrows, and the domestic fowl may be.

LITERATURE CITED

Alderson, H.
1897. Wonderful egg producing powers of the wryneck. Zoologist, ser. 4, 1:512–513.
Bankes, A.
1897. Egg producing powers of the common redshank. Zoologist, ser. 4, 1:575.
Berndt, R.
1943. Wie reagiert der Trauerfliegenschnapper, *Muscicapa h. hypoleuca* (Pall) auf die Fortnahme seines Geleges wahrend der Legperiode. Beit. Fortpfl. Vogel, 19:77–83.
Bisshop, T.
1923. Fecondité du moineau domestique *Passer domesticus domesticus* (L.). Le Gerfaut, 13:23.
Burns, F. L.
1900. A monograph of the flicker. Wilson Bull., 7:1–82.
Burrows, H.
1945. Biological actions of sex hormones (Cambridge. Cambridge Univ. Press).
Cole, L. J.
1917. Determinate and indeterminate laying cycles in birds. Anat. Rec., 11:504–505.
1930. The laying cycle in the house wren. Wilson Bull., 42:78.
Craig, W.
1913. The stimulation and the inhibition of ovulation in birds and mammals. Jour. Anim. Behav., *3:215–221.*
Davis, D. E.
1942*a*. Number of eggs laid by herring gulls. Auk, 59:549–554.
1942*b*. The number of eggs laid by cowbirds. Condor, 44:10–12.
1942*c*. The phylogeny of social nesting habits in the Crotophaginae. Quart. Rev. Biol., 17:115–134.
Farley, J. A.
1924. Argentine birds. Auk, 41:169–170.
Goethe, F.
1937. Beobachtungen und Untersuchungen zur Biologie der Silbermöwe (*Larus a. argentatus* Pontopp.) auf der Vogelinsel Memmerstand. Jour. f. Ornith., 85:1–119.
Grabham, O.
1897. Egg producing powers of the dipper. Zoologist, ser. 4, 1:575.
Groebbels, F.
1937. Der Vogel. II. Geschlecht und Fortpflanzung (Berlin, Gebrüder Borntraeger).
Gwynn, A. M.
1953. The egg-laying and incubation periods of rockhopper, macaroni and gentoo penguins. Australian Nat. Antarctic Res. Exped. Rept., ser. B, 1:1–29.

Heywang, B. W.
1938. The time factor in egg production. Poultry Sci., 17:240–247.

Howell, J. C.
1942. Notes on the nesting habits of the American robin (*Turdus migratorius*). Amer. Midl. Nat., 28:529–604.

Jull, M. A.
1940. Poultry breeding (New York, John Wiley and Sons).

Kreymborg, A.
1911. Ueber das sich-tot-legen-lassen von Vogeln. Ornith. Monatsschrift., 36:86–88.

Lack, D.
1933. Nesting conditions as a factor controlling breeding time in birds. Proc. Zool. Soc. London, 103:231–237.

Laven, H.
1940*a*. Beitrage zur Biologie des Sandregenpfeifers (*Charadrius hiaticula*). Jour. f. Ornith., 88:184–286.
1940*b*. Ueber Nachlegen und Weiterlegen. Ornith. Monatsber., 48:131–136.

Miller, R. F.
1910. Notes on the Florida gallinule (*Gallinula galeata*) in Philadelphia County, Pa. Auk, 27: 181–184.

Nash, F. P.
1942. Attempt to increase number of eggs in clutch of bluebird. Bird-Banding, 13:121.

Nice, M. M.
1937. Studies in the life history of the song sparrow. Trans. Linn. Soc. N. Y., 4:iv + 247 pp.
1949. The laying rhythm of cowbirds. Wilson Bull., 61:231–234.

Phillips, C. L.
1887. Egg-laying extraordinary in *Colaptes auratus*. Auk, 4:346.

Pitt, F.
1929. Notes on the effect of temperature upon the breeding behavior of birds. Ibis, 71:53–71.

Puhlman, E.
1914. Das sich-tot-legen-lassen von Vogeln. Ornith. Monatsschrift, 39:512–515.

Riviere, B.
1897. Egg producing powers of birds. Zoologist, ser. 4, 1:575.

Roberts, B.
1940*a*. The life cycle of Wilson's petrel *Oceanites oceanicus* (Kuhl). Brit. Graham Land Exp. Sci. Rept., 1:141–194.
1940*b*. The breeding behavior of penguins with special references to *Pygoscelis papua* (Forster). Brit. Graham Land Exp. Sci. Rept., 1:195–254.

Rowan, W.
1918. Power of control over deposition of eggs. Brit. Birds, 12:42–43.

Salomonsen, F.
1939. Oological studies in gulls. 1. Egg-producing power of *Larus argentatus* Pont. Dansk. Ornith. For. Tidsskr., 33:113–133.

Spear, I. M.
1942. Herring gull control experiments. Rept. Bowdoin Sci. Station, Bull. 8:15–31.

Stieve, H.
1918. Ueber experimentell, durch veranderte aussere Bedingungen, bervorgerufene Ruchbildings-vorgange am Eierstock des Haushuhnes (*Gallus domesticus*). Arch. Entmech. Org., 44: 530–588.
1919. Die Entwichlung des Eierstockeies der Dohle (*Coloeus monedula*). Arckiv. mikr. Anat., 92:137–288.

Timmermann, G.
1932. Ueber den Einfluss der mittleren tagestemperature auf das Fortpflanzungsgeschaft des Weidenlaubvogels. Beitr. Vogel, 8:214–217.

Von Torne, H.
1940. Wie reagiert die Sturmowe auf das Eierfortnehmen? Deutsche Vogelwelt, 65:38–46.
Walkinshaw, L. H.
1949. Twenty-five eggs apparently laid by a cowbird. Wilson Bull., 61:82–85.
Warga, K.
1925. Viergelege eines Wendehalses. Aquila, 32–33:290.
Weydemeyer, W.
1934. Tree swallows at home in Montana. Bird Lore, 36:100–105.
Witschi, E.
1935. Seasonal sex characters in birds and their hormonal control. Wilson Bull., 47:177–188.

The Johns Hopkins School of Hygiene and Public Health, Baltimore, Maryland, September 15, 1954.

THE WINTER SOCIETY OF THE OREGON JUNCO: THE FLOCK

By WINIFRED S. SABINE

The Oregon Juncos (*Junco oreganus*) of the present study were wild, free-living birds, color-marked, and observed for the most part at two feeding stations, one in the Deep Springs basin in Inyo County, California, and one in Seattle, Washington.

The Deep Springs basin, which is surrounded by parts of the White and Inyo mountains, has an elevation of 5000 feet and is about fourteen miles long by four miles wide. It has no settlement except the Deep Springs School, which operates a cattle ranch and has about 150 acres under cultivation. Lines of large cottonwoods follow the irrigation ditches. Lawns, deciduous trees, and shrubs partly surround the buildings. About 25 feet away from the feeding station a belt of fifteen deciduous trees separated it from the low desert vegetation of the basin as a whole and furnished perching places.

In Seattle the feeding station was in a residential area but was about 300 feet from a heavily wooded section to the north and about 200 feet from a narrow strip of woods to the east. Connecting this wooded strip with the feeding station area was a vacant lot covered with weedy hummocks and heaps of stones and brush. This lot had nine large conifers. There was also a line of trees, largely conifers, running along the back lot lines of the houses in the block.

Canary grass seed and chick feed were the foods provided. The feeding stations were strips of ground twelve feet by four, running parallel with and about six feet from the wall of the house, centered on a window, and bordered on the ends and outer side by heaps of brush from three to seven feet high, in which the birds perched, rested, and took cover. Being indoors the observer was able to make prolonged day-to-day observations regardless of weather. At Deep Springs, 435 hours were spent at the post of observation between October 24, 1948, and January 25, 1949. Observations were resumed on February 20 and totalled about 50 hours before the departure of the birds in March. In Seattle 365 hours were spent in observation between December 28, 1949, and April 3, 1950.

The birds were marked by cementing (with Duco) one or two trout-fly feathers to the top pair of tail feathers close to the body. These markers were durable and varied naturally in shape, texture, and the curve of the shaft, as well as in color. They were trimmed if necessary to about the length of the tail and were cemented to it wrong side up, to be made more readily recognizable by the upward curve of the shaft away from the tail. The markers were conspicuous but did not seem to be noticed either by the wearer or its fellows. When eating in a high wind the marked birds had a little more difficulty with their footing than the unmarked ones, but not to a serious extent. The birds were easily distinguishable as individuals. Marked individuals were named with letter symbols by assigning a different letter to each type of feather; B stood for blue, N for black, and so on. This system brought the name of the bird instantly to mind, a crucial point in observations which rely on the correct identification of swift-moving little birds. Furthermore, the relative positions of the feeding station and the observer were such as to bring the birds within a range of about six to fifteen feet. For observations outside the station binoculars were used as needed.

The observer at a feeding station cannot choose his material. Not knowing which species would prove useful, the writer marked every bird trapped, with the resultant discovery that the juncos formed the only stable visiting group. At Deep Springs 239 birds of eight species were marked, including 120 juncos. One vagrant Tree Sparrow

(*Spizella arborea*) was included. Linnets (*Carpodacus mexicanus*) were irregular and infrequent. The White-crowns (*Zonotrichia leucophrys*) marked in the fall were of the Gambel type and seemed to be migrants; in January three occasional visitors not of the Gambel type were marked and identified as belonging to a winter group resident elsewhere on the ranch. In March White-crowns again visited the station in what may have been a first premigratory move (Linsdale, 1949), since some marked individuals were present for several weeks. These spring migrants included both types. One of these birds had been marked in October. The first-marked Lincoln Sparrows (*Melospiza lincolnii*) also stayed for two or three weeks, as if they were premigratory. Chipping Sparrows (*Spizella passerina*) were fall migrants, and American Goldfinches (*Spinus tristis*) disappeared in December. Brewer Blackbirds (*Euphagus cyanocephalus*) usually flocked in the pastures but came irregularly to the feeding station, driven by hunger after snow covered the ground.

In Seattle heavy snow in January brought Song Sparrows (*Melospiza melodia*) to the station for about four weeks. Thirteen of these birds were marked. Otherwise juncos, of which 33 were marked, were the only visiting birds.

The time spent in marking these transient or irregular birds was not entirely wasted. They provided contrasts in social behavior which tended to sharpen the perception of details in junco behavior.

It is possible that the junco is a steadier visitor than other species at a feeding station, and therefore a more satisfactory object of study, because a fixed feeding spot fits into its normal routine. Persistent return to definite spots seems to be characteristic of its winter behavior. It seems also to be the case that, as the migrants arrive, the population tends to divide for the winter into small flocks of stable membership. Within this social structure two mutually limiting tendencies appear. The winter residents are gregarious but they are also intolerant of the close proximity of fellow members of the species. The limits of tolerable proximity are elastic and vary with environmental conditions, but a reaction of intolerance may be said to be released by a second bird which is tending in one way or another to invade the area of privacy which the reacting individual maintains about itself. A subordinate bird may show its intolerance by avoiding a dominant bird; the latter shows its intolerance by pecking at, or otherwise gesturing at, the subordinate. A straight-line pecking order emerges when these relations are recorded (Sabine, MS).

Gregariousness and intolerance function together in the winter society of the species. It is the object of the present paper to report what was learned about the gregariousness or flocking in the society. A previous study of the Slate-colored Junco (*Junco hyemalis*) had indicated that some elements of a pattern could be traced in the winter flocking of that species (Sabine, 1949).

THE FLOCK AT DEEP SPRINGS

It was anticipated that part of the birds marked would turn out to be migratory and part winter resident. It seemed possible that the two classes would not be overtly distinct in behavior and yet that there might be a tendency for them to separate. Quantitative observations were sought which, when analysed after the transients had identified themselves by vanishing, might throw some light on this point. A start was made on October 30, 1948, by noting the names of the marked birds together with their groupings, but only part of the time was devoted to this; some time was given to the observation of dominance relations. On November 3 priority was given to censusing. The time of arrival at the feeding station and the names of the marked birds were noted for

each group. Unmarked juncos usually accompanied the marked birds. On November 5 a count of the unmarked birds was added to the census, which was kept up through November 29. The figures of this census provided information on a number of points not thought of when it was undertaken and are drawn on heavily in what follows.

Table 1

Assembly of the Color-marked Winter Resident Flock

Date	Number marked, including transients	Number of residents marked	Names of winter residents: Station flock	Names of winter residents: Other flocks	
Oct. 24	3	1	BG		
25	0	0			
26	7	1	CR		Note 1
27	5	2	NO, AG		
28	7	3	RN, GR, X		
29	2	0			
30	1	0			
31	2	0			
Nov. 1	1	0			Note 2
2	1	0			Note 3
3	4	0			
4	2	0			
5	0	0			
6	0	0			
7	3	1	PS		Note 4
8	2	0			Note 5
9	5	3	OC, CZ	BD	Note 6
10	7	2	AD, ND		Note 7
11	----	----			
12	7	3	SA, OG	NC	Note 8
13	5	3	RS, YJ	AT	
14	0	0			
15	0	0			Note 9
16	2	1	AB		Note 10
17	0	0			
18	----	----			Note 11
19	----	----			
20	6	6	CB, R, O, G, CT	B	Note 12
21	2	2	Y, NJ		
22	1	1	LJ		
23	0	0			
24	----	----			
25	1	1	JG		
26	2	2	JO, JD		Note 13
27	1	1	OB		
28	2	2	AO	RA	
29	0	0			
Totals	81	35	30	5	

The assembly of the flock.—On October 2, 1948, the piles of brush for the feeding station, which was surrounded by sand and clumps of Russian thistle, were put in place. On October 16 the first junco, a solitary bird, was sighted lurking in one of these clumps and appearing to watch the white-crowns and linnets already feeding at the station. During the next two days a single junco was sighted in cover a number of times. Then two were sighted and thereafter numbers increased gradually. The birds continued to

lurk under cover, small numbers alighting, departing, and returning at intervals. This process continued for eight days. From subsequent observations it seems probable that some of these individuals were repeaters. On October 24 the juncos first visited the station in small numbers, and the procedure of trapping and marking began.

The lapse of eight days during which juncos visited the neighborhood and watched but did not enter the feeding station is open to the interpretation that during the first period of winter residence a process of familiarization was taking place. Some later events also suggested this theory.

Between October 24 and November 29, 81 juncos were color-marked. Of the 81, 35 proved to be winter residents (table 1). The 46 remaining birds were transient and for the most part probably visitors which were en route in migration. Their daily visits at the station had distinctive aspects when viewed against the knowledge of the residents; these differences will be described in a later section of the paper.

Of the 35 winter residents, five were casual visitors at the station. They were trapped and marked there but revisited infrequently and were later identified as members of a different flock (table 1, col. 5).

The resident flock (col. 4) falls into three groups separated by lapses of time when no new winter residents were taken (October 29–November 6) or only a single bird was captured (November 14–19). The reason for these lapses seemed to lie in the fact that

Table 2

Number of Birds and Number of Visits, November 3–29*

Date	Hours of observation	Residents		Transients		Unmarked	
		Number of visits	Number of birds	Number of visits	Number of birds	Number of visits	Number of birds, calculated
Nov. 3	3	12	6	30	6		
4	4½	30	6	51	9		
5	7	36	6	46	7	72	11.4
6	4	19	6	19	4	50	13.1
7	4¾	21	6	29	4	64	12.8
8	4¾	39	7	37	4	120	17.3
9	7¾	70	9	88	6	163	15.4
10	5	52	10	42	7	99	18.0
12	5	50	12	32	8	119	29.0
13	6½	86	14	81	9	82	11.2
14	4½	59	15	37	7	45	10.3
15	8	119	16	46	4	75	9.0
16	7½	124	17	33	3	94	12.0
17	7	116	17	19	2	75	10.5
18	3	56	17			32	9.7
19	3	49	16			33	10.7
20	4¾	106	20			92	17.0
21	6½	257	25			113	11.0
22	3	102	22			52	11.0
23	4	132	24			49	9.0
24	4½	168	24			66	9.4
25	4	208	24			73	8.4
26	5½	233	27			86	10.0
27	4½	156	27			61	10.5
28	5½	176	28			44	7.0
29	2	92	28			34	10.3

* More than 50 per cent of the newly marked birds had unusually low visiting records on the day they were marked, either reappearing once or not at all. It is probable that they suffered shock from the trapping and marking procedure. Their records on those days were excluded from table 2.

the stream of migratory birds was subject to fluctuations, and that trapping was most successful in the periods of fresh invasions of new birds. There were three reasons for the supposition that swelling and subsidence of numbers occurred in the migratory stream as seen at the station.

1. The census recorded the numbers of marked birds, transients and residents, seen each day (table 2, col. 4 and 6), and the numbers of visits of unmarked birds counted (col. 7). It is assumed that the ratio of the number of marked birds to the number of their visits (col. 3 and 5) on any day will equal the ratio of the unknown number of unmarked birds to the known number of their visits. Table 2, column 8, gives the result of this computation. It appears that the unmarked birds visited the station in their largest numbers from November 8 to 12 (15.4–29 birds) and again on November 20 (17 birds).

2. During observations, the observer noted at times that there were unusual numbers of unmarked birds about, the basis for these impressions being that unmarked birds were seen in larger groups than was usual. After the figures of the census were tabulated, it appeared that groups of more than four or five unmarked birds were actually rare. The census recorded 496 groups of unmarked birds between November 5 and November 29. Their distribution as to size was as follows:

Size of group	1–5	6	7	8	9	10	11	12	13	14
Times seen	419	37	22	7	5	1	1	2	1	1

Groups of eight birds or more were seen only eighteen times. It will be noted later that the incidence of most of these eighteen groups coincided with the dates when the largest number of unmarked birds (as calculated from the totals of their visits) appeared at the station.

3. On five mornings at dawn there were signs of a new invasion. It was routine practice to take a brief look at dawn, which turned out to be the moment when the marked flock gathered in the largest group of the day. On November 2, 8, 10, 12, and 16 the flock foraging inside the station was accompanied by relatively large numbers of unmarked birds on the clumps of Russian thistle outside. The light was too dim and their numbers too large for accurate counting but it was estimated on different mornings that they ran from 20 to 40.

Some of these indications of fresh arrivals were noted also in the pre-census period. For convenience of reference the dates at which probable fresh arrivals were observed have been marked with a note in the right-hand column of table 1. Each such insertion means that on the date in question some or all of the indications of fresh arrivals just described were seen. These waves of fresh arrivals to which the notes refer coincided as a rule with success in trapping (table 1, col. 2), and particularly with the trapping of the winter resident birds (col. 4 and 5). The occurrences to which the notes refer are described below.

Note 1 (October 26). A sudden increase occurred in the number of juncos and 16 were counted in a single group. On or closely following this date 19 birds were trapped (table 1, col. 2) and 6 resident birds were marked (col. 4).

Notes 2 and 3 (November 1 and 2). On November 1 the notebook mentioned twice that "unusually large" groups of unmarked birds were being seen. On November 2 there was an invasion of unmarked birds at dawn, and a "large" group was mentioned later. To be consistent these occurrences should have coincided with stepped-up trapping (col. 2); but this was not the case, only one bird being captured on each of these dates. The reason, however, was obvious. Two Chipping Sparrows (*Spizella passerina*) marked the day before—the only members of their species present—occupied the trap to the exclusion of the juncos. They were completely lacking in trap-shyness. No sooner was the trap reset than one or the other entered. On November 2 they were equally persistent and

finally one was taken five miles away and released. On November 3, 4 juncos were trapped despite the fact that the remaining Chipping Sparrow was trapped eight times.

Notes 4–8 (November 7–12). Between these dates the number of migrants was probably at a maximum. There was a relatively large number of the events that have been interpreted as signifying the arrival of new birds: three invasions at dawn, eleven groups of 8 or more unmarked birds out of a total of eighteen such groups, and four of the five largest calculated numbers of unmarked birds (table 2, col. 8). Trapping success during this period was notable: 29 of the 81 marked juncos (about 36 per cent) were trapped between November 7 and 13. Twelve were winter resident birds (col. 4 and 5).

Note 4 (November 7). Groups of 11 and 14 unmarked birds were counted.

Note 5 (November 8). An invasion was visible at dawn. Groups of 8, 8, and 9 were counted. The calculated number of unmarked birds increased (table 2, col. 8).

Note 6 (November 9). A group of 9 birds was counted. The calculated number of unmarked birds continued higher than the average (table 2, col. 8).

Note 7 (November 10). An invasion was seen at dawn. Groups of 10 and 12 birds were counted. The calculated number of unmarked birds rose (col. 8).

Note 8 (November 12). An invasion was seen at dawn. Groups of 8, 9, and 13 birds were counted. The calculated number of unmarked birds rose more than 50 per cent (col. 8).

Notes 9 and 10 (November 15 and 16). A group of 12 birds was seen late in the afternoon of November 15. On November 16 there was an invasion at dawn and later two groups of 8 birds were seen. These indications of fresh arrivals were not accompanied by a marked increase in trapping; only 2 birds were captured, including 1 winter resident, on November 16.

Note 11 (November 18). A group of 8 birds was seen. Trapping was not attempted on November 18.

Note 12 (November 20). Three groups of 8, 9, and 12 birds were seen. The calculated number of unmarked birds increased (col. 8). Trapping was stepped up: 6 birds were captured.

Note 13 (November 26). A group of 9 birds was seen. Two birds were captured, both winter residents.

The events described above point to the probability that fresh arrivals of migrant birds were more numerous on certain dates than on others. Whether or not on the latter dates there were no migrants at all is not known.

Table 1 as a whole shows that other events were simultaneous with these fresh arrivals. Trapping success (col. 2), the building up of the resident winter groups (col. 3 and 4), and the incidence of fresh arrivals occurred during roughly the same periods. The implication seems to be that the birds were captured soon after their arrival, and I therefore do not hesitate to assume that trapping was relatively prompt. On this basis, 81 birds were captured on thirty-three days, but 54 (or 66 per cent), including 24 of the 35 winter residents, were captured on ten days:

October 26–28	19 birds trapped	6 winter residents
November 7–13	29	12
November 20	6	6
Totals	54	24

Table 1, column 6 shows evidence of invasions of unmarked birds on these dates except November 13, when trapping of the new group in the second period was presumably completed.

Table 1 also shows that clear declines in trapping followed success. It is understandable that more birds should be trapped when more were about, but it is not obvious why the declines in trapping should be so sharp after each migrant influx, dwindling to one or two birds daily or to none. There was no dearth of unmarked birds at any time (table 2, col. 7, 8). The declines were not accidental, due to short hours of observation. November 5, 15, and 17, for example, were among the longest days of observation

(table 2, col. 2), yet not a bird was trapped. The conjecture is offered that there were distinct individual differences in trap-wariness. Among the new arrivals, the individuals that were not trap-shy were readily captured; others required time to get used to the trap, and a remnant was never trapped (table 2, col. 7 and 8). Avoidance of the trap was an observable form of behavior. It is probable also that the marked birds learned temporarily to be trap-shy, since during the assembly of the flock (October 24–November 29) only 5 of the 30 birds in the feeding station flock were retrapped.

Relations of new arrivals to prior arrivals.—The fact that the 7 winter residents captured October 24 to 28 and the 12 captured November 7 to 13 were probably separated by intervals of nine days or more suggested that the records of these two groups might be inspected for evidence that the earlier group had some advantage in having occupied the ground first, or that the two groups tended not to mix.

It is not intended to suggest here that either group arrived as a migratory group. The possibility that birds do migrate in integrated social groups has been conjectured occasionally in the literature and was given some substance when six Slate-colored Juncos were trapped in two successive years at a Massachusetts banding station (Whittle and Fletcher, 1924). Forbush (1929) suggested that neighborhood groups might be preserved during migration. Today this suggestion would be met with reserve. The control of migratory flight is assumed to involve physiological changes in the organism including the deposition of fat, stimulated in part by environmental changes in, for example, temperature or the photoperiod (Odum and Perkinson, 1951; Wolfson, 1942, 1945, 1953), and there is the unstated assumption that these mechanisms exercise primary control, without intervention of social factors. Without more substantial evidence than Whittle and Fletcher's, one hesitates to add to this complex of mechanisms the notion that social releasers synchronize the departures of members of a group.

The inquiry into possible differences of behavior, between a group newly arrived and one that had been in residence for nine or more days, amounted to inquiring whether *J. oreganus,* in becoming a social group temporarily, takes on any of the aspects of a colonial species. Howard and Emlen (1942) remark that familiarity with the environment may be accompanied by intolerance toward intruders or dominance over them in many species. A suggestive precedent was that members of a winter flock of *J. hyemalis* were dominant over, but not distinctively intolerant of, newly arrived spring migrants (Sabine, 1949).

Distinctive dominant behavior did not appear as between the early and late groups mentioned above. The members of the early group were not more intolerant of members of the later group than of each other, nor were they dominant over them. In the pecking order the two groups were interspersed in rank from the beginning.

Since nothing was known about the process whereby the winter flock develops, and since the winter flock does not remain together as a unit, it was considered possible that the birds might tend at least at first to visit the station with members of their own group. To test this hypothesis four members of each group were selected at random and the record of each, in respect to its joint visits with each of the other seven, was compiled. Three birds (BG, CR, RN) made a few more visits with members of their own group; five birds (NO, CZ, OC, OG, YJ) made more with members of the other group. The two groups appear to have coalesced completely.

The last transient was marked November 16 and did not appear the next day. The last two to be seen appeared on November 17. It is noteworthy that in a new invasion which occurred November 20 to 28, 15 birds were trapped and all were residents (table 1). The character of this invasion makes it impossible to guess when the migra-

tory season ended. It may have been merely an accident that no transients were captured. Or it is possible that the migratory season had already ended and that the new group of residents had arrived earlier and merely moved in on the station. Later experience showed that this was not impossible. Or it might be that at the end of the season all migrants were forced to stop by unknown factors of control. If this were the case, it is an interesting speculation that the latest migrants may have been birds of the year which, having no set homing goal, tended to press on until stopped by such factors. The adult junco is a winter homing bird (Linsdale, 1949).

The stability of the flock.—The 30 winter residents (table 1, col. 4) were daily visitors at the station. It was this trait that set them apart from the five marked birds belonging to other flocks (col. 5). The latter had been captured and marked at the station but they were rare visitors. NC's complete record, for example, was as follows: marked November 12, made fourteen visits November 13 (more than any other bird for that day), made four visits December 15, and one visit December 21.

Attendance of the marked birds at the station was recorded from the beginning (October 24) to the end of the observations (April 9). On eight scattered days during this period, and between January 26 and February 19, no observations were made. After the November census was discontinued, the visits of individual birds were not counted, but a daily watch was kept for each bird until it had been recorded once. It was usual but not invariable to see every bird during the first two hours of observation.

A mark of the flock's stability was the small amount of absenteeism. After December 8 no bird of the flock failed to be present each day up to the time when it disappeared for good. Prior to and including December 8, out of 990 possible entries on the roll, 55 (5.5 per cent) were absences. Twelve birds remained until time for migration and had records of unbroken attendance for three to four and a half months. Fourteen birds were never absent from the day they were marked until they disappeared, and 5 of these were among those that remained late. Of the 12 remaining late, 11 disappeared between February 22 and March 14; the twelfth was still visiting the station with a few unmarked juncos on April 9, when observations were suspended.

Sixteen were absentees at least once. Their record was as follows:

Absent	1 day	7 birds		7 absences
	2 days	2		4
	3	2		6
	4	1	(AG)	4
	5	2	(CR, NO)	10
	8	1	(BG)	8
	16	1	(GR)	16
	Total	16		55

The scattered absences of one or two days occurred largely on days when observations were short. The interesting part of this record is that which relates to the birds belonging to the earliest group. Their absences piled up shortly after their arrival (table 1), occurring with two exceptions in late October and the first two days of November. GR did not become a steady visitor at the station until November 14. If the later arrivals attached themselves to this earliest group, a process of familiarization giving rise to absenteeism might not be required.

The marked birds visited the station daily and often, but not as a unit. To illustrate their mode of visiting, November 14 is chosen as a sample and the complete census for that day is given in table 3. (The table includes also the visits of the transients; these will be discussed in a later section.) In many respects irregularity was the rule.

Table 3

The Census for November 14

Time	Winter residents														
	BG	CR	NO	AG	RN	X	PS	OC	CZ	AD	ND	SA	OG	RS	YJ
9:30		CR					PS							RS	
9:36															
11:08					RN						ND				
2:55		CR			RN		PS			AD		SA	OG	RS	YJ
3:15	BG		NO				PS	OC		AD	ND	SA			YJ
3:40		CR													
3:46														RS	
3:52	BG			AG	RN	X			CZ		ND	SA			YJ
4:18															
4:30		CR		AG	RN		PS			AD				RS	YJ
4:43			NO			X		OC	CZ	AD	ND			RS	
4:57				AG								SA		RS	
5:05		CR										SA		RS	YJ
5:15														RS	
5:19	BG				RN	X									YJ
5:23															
5:27															
5:37															
5:43													OG		YJ
Total visits	3	5	2	3	5	3	4	2	2	4	4	5	2	8	7

Time	Transients							Unmarked
	PN	CD	BS	YA	TD	ZD	GS	4
9:30				YA				4
9:36				YA				1
11:08	PN					ZD		4
2:55	PN		BS	YA			GS	5
3:15	PN	CD		YA	TD			5
3:40		CD	BS			ZD		4
3:46					TD		GS	5
3:52								2
4:18				YA				
4:30								3
4:43						ZD		5
4:57			BS	YA				1
5:05			BS	YA		ZD		
5:15		CD	BS		TD			2
5:19			BS		TD	ZD		2
5:23			BS					
5:27		CD						
5:37		CD		YA				1
5:43		CD	BS			ZD		1
Total visits	3	6	8	8	4	6	2	45

1. The timing of visits (left-hand column) shows that 3 residents made a visit at 9:30 a.m. and 2 others at 11:08. This was a long but not an unprecedented lapse of time without visits. Observations were then terminated and resumed at 2:55 p.m. Eleven groups containing winter residents then made visits between 2:55 and 5:19. At 5:43, 2 residents made a visit. There was nothing about this timing that was typical of other days; there was no discernible pattern in the timing of visits.

2. The composition of the groups changed. For example, at 2:55, 8 residents arrived together. Twenty minutes later, at 3:15, another group of 8 arrived; it included 4 of the previous group. At

3:52, thirty-seven minutes later, a group of 8 flew in and included 4 from the preceding group and 3 from the first group; 2 birds had been members of all three groups. Within the hour the entire 15 had been seen.

3. The size of the winter resident groups varied as follows:

Size of group	Number of groups
1 bird	3
2 birds	3
3	3
4	2
7	2
8	3
	16 groups

The impression gained from direct observation was that the birds must be perpetually meeting, forming groups, dispersing, and reforming. Occasionally this process might be seen at the station as members of groups timed their departures differently. But it was common also for a group to arrive and depart together.

4. The bottom line of table 3 shows the number of visits made by each bird. These vary from two to eight.

Frequency of visits and temperature.—The sum of all the visits varied from day to day. In table 4 the numbers of visits made on November 14 and on two additional dates,

Table 4

Frequency of Visits by Winter Residents on Three Days with Observation Periods of Equal Length

Date:	November 14	November 24	November 27
Hours of observation:	4½	4½	4½
Frequency of visits	Number of birds		
1			
2	4		
3	3	1	2
4	3	1	6
5	3	4	5
6		6	5
7	1	4	4
8	1	3	3
9		3	1
10			1
11			
12			
13		2	

November 24 and 27, are arranged for purposes of comparison. These dates were selected because it happened that the hours of observation were the same; hence the numbers of visits are directly comparable. A comparison of November 14 with November 24 and 27 shows that on the latter dates the birds were visiting at higher frequencies. These and similar data suggest that some external controlling factor must be at work. The idea that seemed most plausible and most susceptible of testing was that the birds were responding to changes of temperature.

Deep Springs is a reporting station for the United States Weather Bureau. The equipment for making a continuous record of temperature is not maintained there, but records of a more limited sort were available from the San Francisco office. They in-

cluded three temperature readings (Fahrenheit) daily: the maximum, the minimum, and a reading at 6 p.m. Precipitation and high winds also were reported.

The three upper graphs in figure 1 record the temperature readings from November 1 to 29. The two lower graphs record the daily average intervals between the visits of the winter residents and of the transients.

The figures on which the daily average intervals between visits are based are given in table 2. The time (in minutes) was multiplied by the number of birds, and the product was divided by the total of their visits. On November 3, for example, during three hours of observation 6 birds made twelve visits. The average interval between visits per bird was 90 minutes. Positive correlations which were statistically significant at the 0.01 level were found between the daily average intervals and each of the temperature graphs. The coefficients of correlation were as follows: minimum temperatures, + 0.751; maximum, + 0.674; 6 p.m., + 0.624. The writer is indebted to Professor LaMont C. Cole, of the Department of Zoology, Cornell University, for the computation of these coefficients. From this it is evident that juncos visit more frequently on cold days than on warm days.

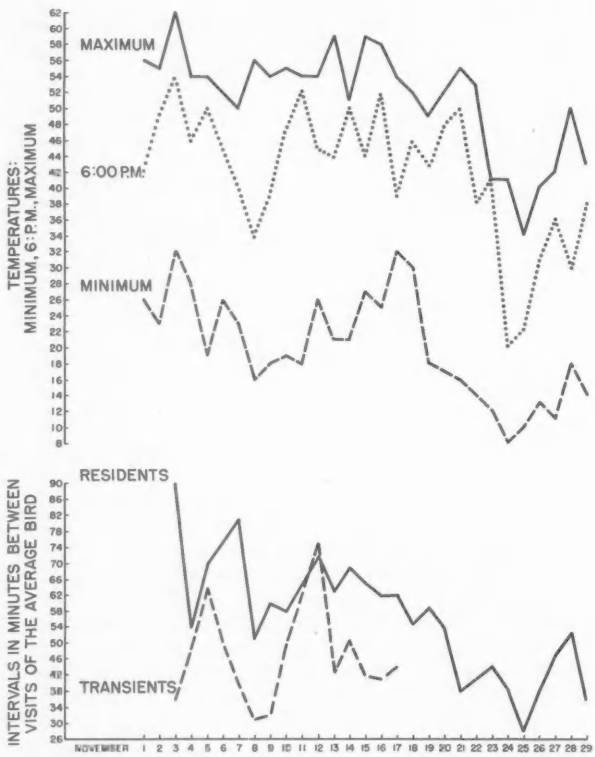

Fig. 1. Correlation of temperature with interval between visits of juncos at feeding station.

The foraging circuit.—If the feeding station flock had moved as a unit—as they at least came close to doing at dawn—they could have been regarded without further evidence as probably a "true" flock; that is, a group integrated by mechanisms which functioned to divide the junco population into such groups. The irregularities illustrated in table 3, however, raised a question about their relation to the feeding station. Was it an area of convergence away from which the marked birds scattered? Some effort was made to find other feeding places frequented either by the marked juncos or by unmarked birds. This part of the work was cut short by the severity of the winter of 1949, which put an end to outdoor observation after December 17, 1948.

Four foraging areas were discovered, or reported by members of the Deep Springs staff.

1. As soon as the earliest group was marked, marked birds were reported as repeatedly visiting an area under an isolated group of large trees. This place was visible from the residence of one of the staff members. These reports, which were made often but were not recorded by the writer, were accepted as reliable evidence that several groups of marked birds visited the place daily. One visit of these birds was watched with binoculars to verify their presence.

2. Another staff member reported that marked birds were repeatedly seen in her back yard, which was surrounded by a tall hedge. It was possible to visit this spot by driving to it and using the car as a blind. An unrecorded number of trips was made, starting November 17. On each trip a group of marked juncos appeared after an interval of half to three-quarters of an hour. On November 30 and thereafter the marked birds present were counted as follows: November 30, 7 birds; December 6, 9 birds; December 8, 16 birds; December 9, 7 birds. Each of these observations was brief, terminating as soon as one group of birds had made a visit. Nevertheless, the four groups seen included 22 of the 30 birds visiting the station.

3. A third foraging spot was discovered by selecting a likely spot and watching it. This was along the main irrigation ditch, by a dense thicket and a solitary tree. Two trips were made, each successful in sighting marked birds. On the first trip three marked birds were identified. On the second a larger number of birds flew off as the writer arrived. They were undoubtedly marked birds though not identifiable.

4. The fourth site was discovered by watching a solitary tree at the base of one of the foothills, close to the road leading to a dairy. Four trips were made and all were successful. After a period of waiting a group of juncos would arrive and forage about the tree and in the crevices between the large boulders of which the foothills are composed. The groups were as follows:

November 17—A group of unmarked juncos.
November 18—AT, BD (table 1, col. 5) and 2 unmarked birds.
November 30—AT, B, RA and a few unmarked birds.
December 6—AT, B, BD, RA and 9 unmarked birds.

These four trips made it reasonably clear that a foraging site of a different flock had been discovered, a site frequented by the four marked occasional visitors, together with unknown numbers of unmarked birds. It was as close to the feeding station as any of the three sites at which the feeding station flock had been found. The distances in all four cases were approximately 300 yards.

These observations suggest that the feeding station birds were an integrated group separate from the surrounding unmarked population. In an irregular, but nonetheless characteristic, way they flew between well defined feeding spots of which the station was one. This trait would point to the division of the population into flocks tending to be exclusive and this conjecture was supported in turn by the discovery of one feeding spot of a flock other than that at the feeding station. The second flock was fortunately identifiable by reason of its including four marked birds which had been rather rare visitors at the station. If the individual birds were integrated by being somehow restricted to a common foraging circuit, it would explain the fact that the flock had a stable membership even though the individuals seemed to have complete freedom of

movement. This seems to be the most plausible interpretation of such facts as were collected.

The unmarked minority in the winter flock.—When the migration season ended in late November, there were still unmarked birds at the station and this condition persisted throughout the winter. These birds presented a problem because I was uncertain whether they were untrapped members of the winter flock or casual visitors from other flocks. Upon continued observation it appeared that their number was relatively stable; it was estimated from day to day as about 25 per cent of the total of visiting birds. (It seems probable that this estimate was not far off. The figures for late November in table 2, columns 4 and 8, which were not available until the observations were over, support it reasonably well.) If so many were casual visitors, this threw doubt on the idea of integrated winter flocks and challenged the theory that these were distinguished by having separate foraging circuits.

When the observations were concluded, the actual performance of the five marked visitors from other flocks (table 1) provided a measure of probable behavior for such visitors, and then it no longer seemed plausible to suppose that the unmarked birds could in the main be anything but members of the station flock. The known visitors had appeared at long and irregular intervals, as will be shown in the section following. The marked birds, on the other hand, made many visits; for example, on November 26, there were 233 in 5½ hours of observation. To suppose that a third as many visits were made by irregular visitors from other flocks, which might then not appear for a week or a month, and that these were replaced by a new contingent next day, would amount to assuming the presence of a constantly changing stream of individuals. If this were the case, it is difficult to see why it was unusual to trap them. Experience during the migration season showed that fresh arrivals seemed to be followed by successful trapping. It is impossible to say how many visitors were trapped during this season because they were indistinguishable from true migrants. But during the winter only one visitor, a bird that disappeared after trapping, was captured out of 18 birds, although the trap had been set for nine days.

It also seems probable that if the unmarked birds had been visitors, there would occasionally have been visits by a large group of them. This, however, did not happen. The unmarked birds mingled with the marked in small numbers, or occasionally appeared in small groups, as would be expected if they were members of the station flock. The most likely conjecture seems to be that the unmarked birds at the station were trap-wary members of that flock.

The reduction of the flock.—The heavy loss in marked birds, whose numbers gradually fell from 30 to 12, might be interpreted as due to instability in the composition of the flock or to dispersal in midwinter. (Similar losses reduced the dairy flock from 20 to 8.) However, four losses were known to be due to illness, exhaustion, or exposure, and predators were unquestionably an important cause of losses. Early in January a Loggerhead Shrike (*Lanius ludovicianus*) and two half-wild ranch cats began to besiege the station. The losses in marked birds for three weeks were at about the rate of one bird per day but ceased after these predators were shot. There were certainly other predators, also. One bird was taken by a predator perching nearby—probably a Sparrow Hawk (*Falco sparverius*)—as it was released after being marked. In view of these known losses, it does not appear that the reduction of the flock was a reason for doubting its stability.

The amalgamation of two flocks.—About 8:00 a.m. on December 7 the feeding station was visited by 17 unmarked birds. For the remainder of the day and subsequently

the estimated percentage of unmarked birds rose sharply and remained the same, showing that the invasion had not been a momentary affair. Estimates of unmarked birds, which flew in with marked birds, were "at least half" or "probably more than half."

There was also an addition to the marked birds. The four marked birds seen at the dairy site the day before (December 6) began making daily frequent visits to the station and continued to do so. It seemed necessary, after the lapse of a few days, to accept as a fact the idea that the dairy flock had moved in, at least at the station, with the station flock.

The rise in the percentage of unmarked birds was unquestionable, and also a change in the behavior of the four marked birds of the dairy flock. These birds had been rare visitors at the station, if compared with the flock members. Their record before December 7 follows:

BD	November 9–December 6	4 visits
AT	November 13–December 6	11
B	November 20–December 6	3
RA	November 28–December 6	6

At the same period, for the fourteen days from November 16 to 29, inclusive, 15 members of the station flock averaged 87 visits each. From December 7 on, the four birds from the dairy flock came as frequently as the other marked birds. It seemed reasonable to regard them as "indicators," signifying that the newcomers on December 7 really were the dairy flock.

Accordingly it became of interest to know whether these "indicator" birds visited the feeding station only, or whether they visited also the other sites in the foraging circuit of the station flock. On December 8 three of the four "indicators" were seen at one of these sites with 13 members of the station flock; and on December 9, one was seen at the same place with six of the flock. On the same date, one "indicator" was seen at the irrigation ditch site with two members of the flock. These joint visits suggest that the two flocks became completely amalgamated.

It was of interest to discover, also, whether the "indicators" continued to visit the single known site frequented by the dairy flock. Five trips were made to the site, four lasting about half an hour each and one of two hours. No juncos were seen at any time. Since an interval of two hours without a single visiting junco had not been experienced at the feeding station, this seemed to indicate that the dairy flock had abandoned this site. Further work along these lines was prevented by severe weather.

There was no sign that the original members of the station flock distinguished the new invaders with discriminatory intolerance. As occasional visitors before December 7, the marked "indicator" birds had been treated without special intolerance, and this was probably representative of the treatment of the unmarked birds after that date. Fragmentary indications of rank in the pecking order showed that the newcomers were not uniformly subordinate to the members of the flock; RA was dominant to a large number of them but AT seemed to be subordinate to all. When the pecking order was worked out later, these relations held.

The trapping of the new flock was postponed because the observer was reluctant to add to the 27 marked birds already present until dominance relations among these 27 had been more reliably ascertained. The visits of the "indicators" and the estimated percentage of unmarked birds were constantly checked, and they remained unchanged for three weeks. On December 28 trapping was started and it revealed the characteristic trapping pattern of the assembly period: seven birds were captured the first day and one or two daily thereafter for nine days. Eighteen birds were marked; of these one was never seen again and one was a crippled bird found dead a few days later. Thereafter

the percentage of unmarked birds returned to the former 25 per cent, indicating that the dairy flock also had its quota of untrapped birds.

The daily record of the dairy flock showed the same unbroken attendance characteristic of the station flock. Eight of the 20 survived to migrate. During the migration season in March, one of the dairy flock was not seen for three days, then reappeared for three days, then vanished, an exception to the rule that every bird was seen daily.

So far as could be seen, the coalescence of these two flocks was immediate and complete. It suggests comparison with the original assembly of the flock and the immediate coalescence of newly arrived migrants with birds already on the spot. In this species it appears that a newcomer releases no hostile reaction from members of a group which

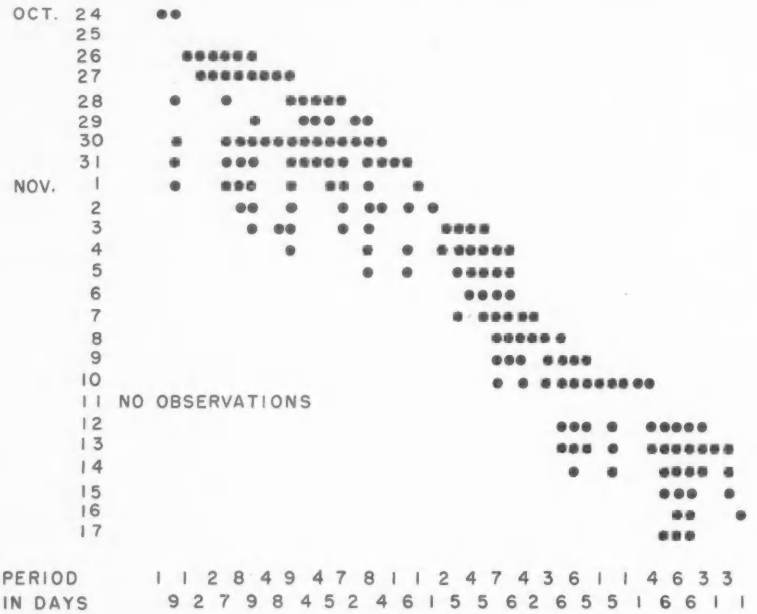

Fig. 2. Attendance at feeding station of 46 transient juncos. Horizontal lines give number of transients seen on each date. Vertical lines give records for individual birds. Bottom lines record numbers of days between first and last appearances of each transient.

already know each other (as witness the controlled approaches and avoidances of other juncos in accord with relations of dominance) and are already familiar with the environment.

On January 22 the feeding station was again invaded by an unusually large percentage of unmarked birds, which persisted for three days. On January 25 eight birds were trapped, suggesting the usual pattern. When observations were resumed in February, six of these birds were still visiting the station and mixing with the other birds. Two disappeared soon after, and the remaining four, which vanished between March 6 and 16, had nearly unbroken records of attendance. This invasion seemed to duplicate experience with the dairy flock and thus suggests the moving in of still a third flock.

Evidence of a process of familiarization.—Three sets of facts suggest that the early birds, upon their arrival, underwent a process of routinization, or of familiarizing themselves with the environment. Two such facts have already been mentioned. First, the juncos first seen watched but did not enter the station for eight days. Second, of the group of seven birds first marked, four were not seen for several days immediately thereafter but became steady visitors on November 2 or 3; one bird was never absent and one was absent only one day. Third, the remaining bird of this group, GR, was especially interesting, since its behavior made it possible to observe the steps by which it apparently became used to the station and its feeding arrangements. Food was spread both on the ground and on a bench. GR's behavior as recorded in the notes was as follows:

October 28: trapped.

November 1, 2, and 8: seen once briefly; no visits on intervening days.

November 15: made two visits; scratched under brush; did not approach food.

November 16: made 13 visits; at first visits scratched under brush, visits lasting several minutes, emerged twice momentarily; during last visits came out in the open occasionally.

November 17: made 13 visits; stayed in the brush but came frequently into the open; finally ate on the ground with other birds.

November 18, 19, 20, 21: ate on the ground but restricted its movements more than other birds.

November 22 and 23: continued to eat on the ground; often perched high in brush and seemed to watch birds on bench.

November 24: began to eat on bench.

One bird from the middle group (table 1) also showed similar hesitancy, tending to stay in the brush for two days. The writer has observed behavior similar to GR's in Slate-colored Juncos (Sabine, 1949), and something that appears to be analogous has been reported for hens introduced into new quarters (Douglis, 1948). Howard and Emlen (1942) and other observers have reported cases in which unfamiliar surroundings seem to influence behavior.

An objection might be entered against giving so much weight to the exceptional behavior of one individual. It has been the writer's experience in observing juncos that individually distinctive behavior is an exaggeration of a trait common to the species.

The transients.—Of the birds marked (table 1), 46 were transients. In view of the season, it seems probable that a large proportion of these were migrants, but some transients may have been winter residents that were members of other flocks.

In the length of their stay, as seen at the station, the transients varied from one to nine days (fig. 2, bottom lines). The earlier part of the period included birds that stayed seven, eight, or nine days. Those which stayed five or six were largely captured later. Birds present from one to four days were scattered throughout. The number of marked transients seen on any one day varied from 2 on the first day (October 27) to 14 on October 30 to 2 on the last day (November 17).

In six instances, two or three transients disappeared on the same day. This suggested the conjecture that these birds might belong to integrated migratory groups and so might be visiting the station together. An examination of their visiting records, however, did not support this. There was no special tendency to joint visits by these groups; joint visits occurred oftenest merely between birds that were most frequently seen. Table 3 shows the joint visits of all birds, resident and transient, on November 14. On that day, for example, BS, YA and TD, which all disappeared on November 18, made records as follows: TD made four visits, one with YA and two with BS, but two also with RS and YJ, which were both winter residents. The same sort of relationship held between BS and YA, and between each of these and two winter residents; there were

three joint visits between the transients, and three or four between them and winter residents. The record for November 14 is typical; the result would be the same if joint visits on any other day were examined.

The behavior of the transients differed from that of the residents in one respect: they visited the station oftener. This may be presumed to mean that they consumed more food than the residents. Table 5 compares the visits of 20 transients with the aver-

Table 5

Comparison between Frequency of Visits by 20 Transients and Mean Frequency of Visits by Winter Residents

Individual transients	Period of observation	Number of visits by *each transient*	Average number of visits by residents *per bird*	Number of *residents*
BA	*Oct. 30–Nov. 1*	*10*	*4.5*	*6*
RY	Oct. 30–Nov. 1	9	4.5	6
BC	Oct. 30–Nov. 1	12	4.5	6
GW	Oct. 30–Nov. 2	13	5.2	6
AR	Oct. 30–Nov. 3	23	7.2	6
LA	Oct. 30–Nov. 3	32	7.2	6
WN	Oct. 30–Nov. 4	28	12.2	6
YO	Oct. 30–Nov. 5	22	18.3	6
TB	Nov. 3–Nov. 7	20	16.5	6
ZR	Nov. 4–Nov. 7	25	17.6	6
BP	Nov. 4–Nov. 9	58	32.3	6
GT	Nov. 4–Nov. 10	74	37.0	6
WD	Nov. 8–Nov. 10	29	18.0	7
SC	Nov. 9–Nov. 13	42	23.5	9
SO	Nov. 10–Nov. 13	7	16.0	9
PN	Nov. 9–Nov. 14	20	27.0	9
CD	Nov. 12–Nov. 14	24	13.2	12
BS	Nov. 12–Nov. 15	34	21.0	12
YA	Nov. 12–Nov. 17	62	34.0	12
TD	Nov. 12–Nov. 17	50	34.0	12

age number of visits by the winter residents present during the same period. The 20 transients include all the birds that had visited the station on three or more days after records became available.

In two instances (SO and PN) the visits of the transients were fewer than the mean visits of the residents; in eighteen instances the transients made a larger number of visits. The percentage of excess varied, from YO with 20 per cent more than the average of the winter residents to LA with 340 per cent. Nine transients exceeded by less than 100 per cent, five by more than 100 per cent, and two by 100 per cent. These variations reflect considerable differences between individual transients. Some of them also ate for unusually long periods, a factor not taken into account in the number of visits. Typically the junco eats longest when solitary. It ceases to be restless, sits back on its heels, eats without moving, and may continue so up to twenty minutes. The transients made twelve solitary visits as against five by the winter residents, though the latter were more numerous. YA made five such visits. On one day, for example, GT visited the station 23 times in 7½ hours and ate for periods of six, ten, twelve, and eighteen minutes, ignoring the coming and going of other birds. Normally only a solitary junco eats for periods of such length.

The two lower graphs in figure 1 contrast the feeding performance of all the winter residents with that of all the transients by means of the daily average interval between

their visits. Except on November 12, when their average was affected by the small number of visits by PN and SO (table 5), the transients visited at substantially shorter intervals. Their feeding, however, was apparently not modified by changes of temperature. Unlike the case of the winter residents, no significant correlation is demonstrable between the variation in their average intervals and the changes of the three temperature readings (fig. 1, upper graphs). The small number of transients may possibly be responsible.

This distinctive aspect of behavior among transients, and its possible independence of temperature changes, probably reflects the need for a presumed deposition of fat associated with migration. Odum and Perkinson (1951), in a study of the White-throated Sparrow, have shown that such a deposition of fat is a prerequisite for migration, and they suggest that during long migrations these lipid deposits may be used up and may need to be replenished. Their study concerned the spring migration. The feeding behavior of the junco transients suggests that this species stops to replenish its migratory fat during the fall migration.

There is some evidence that the migrating birds that paused in their flight did not forage at random but attached themselves to a winter-resident flock. The vertical lines in figure 2 show that there was a difference in the proportion of absences between the transients marked between October 24 and 31 and those marked between November 1 and 16, as follows:

	Total number marked	Number appearing 1 day or 2 consecutive days	Number appearing with no absences	Number appearing with absences
Oct. 24–31	20	4	6	10
Nov. 1–16	26	9	15	2

The early transients, like the early winter residents, had spasmodic records with many absences. The later transients, a different set of birds no more familiar with the environment than the earlier transients, were nevertheless consistent daily visitors. In this respect they were like the late-arriving winter residents referred to earlier. It seems reasonable to suppose that they were consistent visitors for the same reason, namely, that they attached themselves to a group already routinized. The attachment thus inferred from the records of absenteeism is supported by the direct observations on five occasions at dawn (November 2, 8, 10, 12, 16), when large groups of unmarked birds were seen foraging outside the station along with the marked birds inside. A mechanism effecting such an association would distribute the transients among the wintering population and should therefore limit the number of them appearing at any one feeding spot. The number of visits by unmarked birds (table 2, col. 7) and the computed number of unmarked birds based on it (col. 8) fulfills this expectation.

THE FLOCK AT SEATTLE

The composition of the flock.—The feeding station at Seattle was set up on December 21, 1949. Juncos were in the neighborhood and at once started to visit in groups ranging up to 19 individuals. Trapping was begun on December 28. Table 6 shows that 32 birds were captured. They are divided into the classes which subsequent events showed probably to be correct. At first, however, no distinctions could be made between the birds in columns 2, 3, and 4. They seemed to be a feeding station flock of 26 birds. The six casual visitors were identifiable by the infrequency of their visits (col. 5) as at Deep Springs.

Snow began to fall on the second trapping day (December 29) at noon, and for the following five weeks fresh precipitation and low temperatures maintained a substantial

ground cover of snow. On February 4 and 5 a rapid thaw set in. These two dates were marked by the complete disappearance of the six casual visitors and the seven birds "from other flocks" in table 6. Ten days later one of the latter was seen twice, and 14 days later another was seen four times, after which they were not seen at the station again. During the preceding five weeks they had not been rated as casual visitors because the frequency of their visits seemed to place them within the flock. From these striking simultaneous disappearances it may be conjectured that these seven birds were only apparent members of the flock but really belonged to a third category, namely birds from other flocks which were nevertheless frequently present and had been brought to the station by the snow. The station was outside their usual foraging circuit and they detached themselves from the station when the difficult foraging period ended.

Song Sparrows (*Melospiza melodia*) were displaying analogous behavior at the same time. Of this species, 13 were marked, the first proving in the spring to be the resident male holding the breeding territory around the station. Like the juncos, these birds made frequent visits to the station during the period of snow, despite their intense intolerance of one another. With the exception of the "owner" and one other male, which was later observed to be a contender for the territory, the Song Sparrows also vanished with the thawing of the snow.

The departure of 13 juncos left 19 birds as the station flock (table 6, cols. 2 and 3), probably a mixture of residents and winter residents. These two groups became distinguishable at the time of the spring migration.

The integration of the flock.—A census was kept from January 5 to 26. It showed the same types of irregularity in timing, grouping, and individual visiting that had prevailed at Deep Springs and are illustrated in table 3. In one respect, however, the Seattle flock differed from that at Deep Springs. Presumably because of its smaller size, it sometimes moved as a unit, all the birds appearing together.

A daily roll also was kept in Seattle throughout the observations. Absences were most numerous at first but declined to zero after February 20. Of the 10 absences noted below during the period of dispersal, six were those of a single bird.

	Number of days	Number of birds	Number of absences	Percentage of absences
Jan. 5–11	7	18	45	.36
Jan. 12–24	13	19	30	.12
Jan. 25–Feb. 4	10*	19	17	.09
Feb. 5–20	....	....	....	....
Feb. 21–25	5	19	0	.00
Feb. 26–Apr. 3	37	decreasing	10	

* No observations on February 2.

A conjecture might be made that absences were more numerous at first because, when a new feeding spot is included in a circuit already routinized, the birds may require time to become familiar with it. Some light was thrown on this point when a new baited area was started on February 22. Few birds went to it at first, but its use increased markedly as time went on.

During the interval without recorded absences shown above, there was an almost complete lapse in visits at the station. Eight observations made at dawn during this period showed from 6 to 16 birds. On several of these days, not a single junco was seen at a later hour. The weather was still, dull, and humid, with occasional rains, mists, and fogs. Undoubtedly these conditions limited foraging. A gleam of sunshine almost instantly brought large groups to the station.

The existence of a foraging circuit (referred to above as possibly already formed before the station was set up) could not be verified at Seattle; rather, it was assumed on the basis of the evidence gathered at Deep Springs. The prevalence of conifers and a maze of fenced yards was unfavorable to tracing the marked birds, and it was not possible to select one site for observation as more likely than another. There was, however, one feeding spot frequented by the birds that happened to be visible from the post of observation. It was a patch of lawn about 30 yards distant from the station. Flights from the station to this spot were not counted but they were numerous and were seen probably every day. A group at the station might move to it as a unit, or a part of the group might do so. As between this spot and the feeding station, the behavior of the birds was like that at Deep Springs, namely, foraging groups as a rule moved from one small area to another.

Table 6

Schedule of Marking and Tentative Classification of the Flock at Seattle

Date trapped	Residents	Winter residents	Residents from other flocks	Casual visitors
Dec. 28	OR, TM, P			
29	Q, OC, W, C	Y, R, GM	L	
30	LG	GP	PR	PY
Jan. 1	OW, WY, TW	OG	LC, CM, ML, TR	TY
2		YM	YR	CW
4		TC		
9				GY
12	CG			
14				MW, OP

Only one marked bird was lost from the Seattle flock. It was trapped on the first day (December 28). It is not listed in table 6 because its early disappearance after thirteen days of frequent visiting prevented its tentative classification. This low rate of loss probably reflects the absence of predators. None was seen at the station, and predatory birds were doubtless less numerous in the Seattle area than in the almost undisturbed wildness of the Deep Springs basin. It seems reasonable to regard the low rate of loss in Seattle as supporting the interpretation that the high losses at Deep Springs were due to predation rather than to inherent instability in the social structure of the flock.

At Deep Springs the presumption that the marked birds formed a stable group was somewhat clouded by the presence of unmarked birds. The conclusion that these were probably trap-shy members of the flock rested on a reasonably plausible network of observations and interpretations, but it could not be tested. In Seattle this element of uncertainty was reduced to a minimum. The 19 birds of the flock (table 6, cols. 2 and 3) were never accompanied by more than three unmarked birds. Of these one was very dark and was identifiable because it was number 4 in the pecking hierarchy. One was unusually small and pale-colored. The third was medium in coloration of the hood. These features could be readily seen in a good light and when the bird was quiet. Two unmarked birds alike in coloration were never observed together at any time when such comparisons were possible, and such opportunities were fairly frequent. Special attempts to trap these unmarked birds showed that they were observably trap-wary.

These facts tend to support the conclusion that the more numerous unmarked birds associated with the marked flock at Deep Springs were also trap-wary. The unchanging

membership of the Seattle flock supports the view that juncos in winter are integrated by some means which tends to segregate flocks from each other.

The dispersal of the flock.—The tentative classification of the winter flock into residents and winter residents, as shown in table 6, was suggested by differences of behavior when the flock dispersed in the spring. Seven birds (col. 3), like the winter residents at Deep Springs, visited the station daily and vanished abruptly. They were distinguished from the remaining 12 birds (col. 2) superficially by the fact that they disappeared earlier. At the station a sprinkling of unmarked birds noted on February 22 was the first sign that migration was underway and the presumed winter residents were last seen from February 25 to March 2. These early departures were interpreted as meaning that these seven birds were migratory, since they failed to display an attachment to the winter feeding area which was exhibited by the remaining 12.

The dispersal of the residents was associated with the retention of the area as breeding territory by the dominant bird of the winter pecking order. The order of dominance of the 12 residents was as follows: OR, TM, TW, W, OW, YW, CG, C, LG, P, Q, and OC. OR mated with LG. This fact was first noted on February 28 as probable. How much earlier the mating process had started is not known. It was not evidenced by any courtship gestures at any time, being shown by an increasing tendency for the two to arrive and depart together. This lack is a reminder of the probable incompleteness of observations collected at a single post. It seems likely that some courtship gestures occurred. The writer has seen them in a different pair of the species and also has seen elaborate displays in a migratory flock of *J. hyemalis* (Sabine, 1952).

Another fresh development, the appearance of new types of intolerant behavior on the part of OR, was first noted on February 17. These did not destroy the gregariousness of the flock. So long as the birds were visiting the station, they continued to do so in groups with the mated pair or either of them. Nor did the new behavior supersede normal winter intolerance. It was discriminatory and occasional, being evoked by certain birds, especially at first, and becoming a more general irritability of the mated pair toward the end of March.

In order to describe these special forms of intolerance, it is necessary to explain the normal winter intolerance which was a background for it. With the junco, intolerant behavior in winter, during the flocking phase, seems to be essentially a means whereby gregarious individuals become spaced as they eat or perch. The spacing is maintained with some sharpness. In order to study it the feeding station had been enlarged in February to 56 square feet (14×4). With abundant baiting evenly distributed, this area would accommodate 10 or 12 birds about two feet apart with only a small amount of pecking at first, and quiet feeding without pecking might continue for several minutes. With fewer birds there might be no pecking; that is, no evidence of intolerance might be evoked.

Against the background of this characteristic behavior, the new manifestations of intolerance by OR stood out as extraordinary. The first object of OR's special intolerance was TW. Instead of being ignored in the normal way with the spacing just mentioned, TW was attacked at sight by swoops from long distances, even the whole length of the station. Such attacks always permitted TW to keep ahead; the junco is a ritualistic antagonist. TW's response might be to leave at once, but more often TW resisted by remaining at the station and being chased around it, sometimes for several minutes. TW's resistance did not include an attempt to peck or chase OR but consisted only of a persistent refusal to depart. Either bird might break off such a chase by taking its departure, although TW would do so more frequently than OR. By March 13, OR had

extended his attacks to all the birds except C, Q, and OC; C and OC had been subjected to intolerant pecking and chasing by OR's mate, LG.

The common element in all variations of OR's behavior was the indication that winter spacing for eating was now too close. OR no longer ignored birds eighteen inches or two feet away. In this behavior the birds of higher rank were selected for special intolerance (perhaps the males), but it was nevertheless spasmodic. OR lapsed into normal winter tolerance at times and ate with the flock. About March 27 he became generally irritable with all birds (except his mate) at all times, including unmarked birds that had invaded the area. But he was especially irritable toward TM, second in the pecking order, which with OC, the omega bird, had lingered longest at the station.

LG also became intolerant, chased the birds below her in rank, and before the dispersal was completed showed that she had become dominant over 5 of the 7 birds superior to her in the line of dominance. It seems reasonable to suppose that she became dominant to all, although contacts between her and the other 2 birds were not observed. What was seen at the feeding station was not necssarily a complete record of her behavior.

The three birds that ranked immediately below OR in the pecking order also developed sporadic but strong intolerant behavior of the same type. It was first noticed in the case of TW on February 23, of TM on February 27, and of W on February 28. If this order was not merely an accident of observation and if TW really was the first bird below OR to develop what may be called territorial behavior, it might account for the fact that TW was the first bird toward which OR showed strong discriminatory intolerance. TM, TW and W also showed by their reactions to fellow juncos that they were in a phase similar to that of OR. There was no reason to suppose that they had mated, and it might therefore be inferred that OR had probably developed territorial intolerance before mating. The relation of these birds to each other and to the lower-ranked birds of he flock did not disturb the pecking order as it had prevailed during the winter, except of course in the case of LG.

One practical effect of the expanded intolerance shown by OR was to prevent the other birds from eating. Although only one bird at a time had his attention, the others were disturbed and showed it by moving about and occasionally even by taking cover in a dense part of the brush. Instead of departing, they used the subordinate birds' most characteristic method of resistance, which is to remain, retreating to the brush and returning when the opportunity offers. By this method they were often able to eat after OR departed.

The departures of the 10 birds other than OR and LG took place singly between March 12 and April 3. The history of the dispersal suggests that there was an initial attachment to a familiar environment not only by OR and LG but by all the birds. The ultimate detachment was resisted for a considerable period. Starting not later than February 17, the periods of resistance of the 10 individuals ranged from nearly a month to forty-six days. It might be considered an even stronger sign of attachment that several birds, probably males, developed territorial behavior similar to that of OR. The intolerance of OR and LG probably had its place among the stimuli bringing about the conditions that led to the dispersal.

SUMMARY AND CONCLUSIONS

Observations of two winter flocks of free-living, color-marked Oregon Juncos (*Junco oreganus*), made at feeding stations in eastern California and Seattle, Washington, and during successive seasons, provided evidence for the following tentative conclusions:

1. Such flocks are integrated and stable in membership up to the time of dispersal in the spring, when migration or the establishment of breeding territory begins.

2. Integration into a stable flock is apparently effected by the restriction of individual birds to a common feeding circuit consisting of definite feeding spots. Within the circuit solitary individuals and groups of all sizes move freely. A relatively large flock rarely if ever moves as a unit but relatively small flocks may do so.

3. A process of familiarization takes place in the case of the earlier birds of a flock introduced into a new environment. Later birds do not experience this process, presumably because they attach themselves to birds already routinized.

4. It is possible for two neighboring flocks to amalgamate permanently. When this occurs, there is some evidence that the newcomers may abandon the feeding circuit they have formerly used and adopt that of the flock with which they amalgamate. There is no evidence of hostile intolerance on the part of the flock in possession of the feeding circuit.

5. The average daily visits of resident members of the flock, and hence presumably their food intake, show a demonstrably significant correlation with temperature. More frequent visits were made on cold days.

6. It is possible for visitors not members of the flock to utilize a feeding spot for several weeks when feeding is difficult by reason of heavy snow. Such visitors come as frequently as members and mix freely with the flock, but they detach themselves completely when normal feeding conditions are restored.

7. A winter flock may be composed wholly of winter residents or, in a region where the species breeds, may include both residents and winter residents.

8. Individual birds from other flocks make casual and infrequent visits at a feeding spot, together with the members of the flock in whose foraging circuit the spot falls. There is no display of intolerance toward such visitors.

9. Juncos show individual differences in trap-wariness, some never entering traps.

10. Transients that pause in their migration may feed more frequently than winter residents. They probably attach themselves to flocks already established and do not forage at random.

11. The dispersal of a flock of winter residents at the beginning of the migratory season takes place in a series of abrupt disappearances. The dispersal of a flock of resident birds may be effected by the emergence and intensification of a special form of intolerance, not characteristic of winter behavior, on the part of a dominant male and his mate. Resident birds offer a passive resistance to this aggressive intolerance, which interferes with foraging, before they disappear. The effect of this special intolerance is to expand the narrow spacing tolerated in the close social relations of the winter flock into the wide spacing characteristic of the breeding phase of the species.

LITERATURE CITED

Douglis, M. B.
1948. Social factors influencing the hierarchies of small flocks of the domestic hen: Interactions between resident and part-time members of organized flocks. Physiol. Zool., 21:147–182.

Forbush, E. H.
1929. Birds of Massachusetts and other New England states. Part III. (Massachusetts Department of Agriculture).

Howard, W. E., and Emlen, J. T., Jr.
1942. Intercovey social relationships in the valley quail. Wilson Bull., 54:162–170.

Linsdale, J. M.
1949. Survival in birds banded at the Hastings Reservation. Condor, 51:88–96.

Odum, E. P., and Perkinson, J. D., Jr.
1951. Relation of lipid metabolism to migration in birds: Seasonal variation in body lipids of the migratory white-throated sparrow. Physiol. Zool., 24:216–230.
Sabine, W. S.
1949. Dominance in winter flocks of juncos and tree sparrows. Physiol. Zool., 22:68–85.
1952. Sex displays of the slate-colored junco, *Junco hyemalis*. Auk, 69:313–314.
Whittle, C. L., and Fletcher, L. B.
1924. Further observations on the group habit among birds. Auk, 41:327–333.
Wolfson, A.
1942. Regulation of spring migration in juncos. Condor, 44:237–263.
1945. The role of the pituitary, fat deposition, and body weight in bird migration. Condor, 47:95–127.
1953. Gonadal and fat response to a 5:1 ratio of light to darkness in the white-throated sparrow. Condor, 55:187–192.

Ithaca, New York, September 11, 1954.

THE NATURAL TERMINATION OF THE REFRACTORY PERIOD IN THE WHITE-CROWNED SPARROW

By DONALD S. FARNER and L. R. MEWALDT

In a number of the avian species in which testicular development can be evoked by increased daily photoperiods it has been found that such development cannot be sustained indefinitely and that there is a period following each cycle of development during which increased daily photoperiods are ineffective. This period is commonly designated as the refractory period. Much of the available information concerning this phenomenon has been reviewed by Burger (1949) and Miller (1954). In the course of experiments in our laboratories on the photoperiodic control of gonadal and migratory cycles in the Gambel race of the White-crowned Sparrow, *Zonotrichia leucophrys gambelii*, it has been necessary to ascertain quite precisely the time of natural termination of the refractory period. The results of our studies of this phenomenon now prove to be supplemental to those obtained by Miller (1954) on this subspecies in his investigation of the refractory period in three subspecies of *Z. leucophrys* and in the Golden-crowned Sparrow, *Z. coronata*. However, since our experiments involved numbers of *Z. l. gambelii* considerably greater than were available to him, it would appear useful to publish some of our data and observations. The investigations reported here were supported in part by funds provided for biological and medical research by the State of Washington Initiative Measure No. 171.

THE EXPERIMENTS

The experimental and control birds were captured with Japanese mist nets in the vicinity of Pullman, Washington, during September and in the Snake River Canyon about 15 miles from Pullman in October. The birds were held in large outdoor aviary cages until the experimental treatments were begun. The environmental temperatures to which these were subjected were similar to those of the wild controls but usually were 3°C. lower. The six experimental groups were placed in experimental cages in a well ventilated indoor aviary according to the schedule and in the numbers indicated in table 1. Each cage received 40 to 70 foot candles of continuous light from incandescent lamps for 15 hours per day. The temperature of the aviary could not be controlled. Consequently the temperature to which the later groups were subjected during the 5-week period of treatment were lower than those to which the earlier groups were subjected (table 1). However, our earlier studies (Farner and Mewaldt, 1952) indicate that whereas these lower temperatures might result in a slightly lower rate of photoperiodic response, the time at which the response begins is not altered. Water, grit, and nutritionally adequate food were provided *ad libitum*. Weights were obtained and recorded weekly; weekly inspections of the plumage were made and the observations recorded. After 34 days the birds of each group were killed and autopsied; the gonads were placed in alcohol-formaldehyde-acetic acid fixing mixture. After thorough impregnation with the fixing mixture, the testes were weighed rapidly on a Roller-Smith precision balance to the nearest fifth of a milligram. For histologic examination one testis from each male was imbedded in paraffin and sectioned at 8 micra; the sections were stained with acid hematoxylin and yellowish eosin.

RESULTS AND DISCUSSION

The responses, as indicated by changes in testicular weights and spermatogenic activity, are summarized in table 2. The first-year and adult birds are not treated separately since we found no differences in the time of termination of the refractory period.

In this respect our observations are in accord with those of Miller (1948, 1954) on *Z. coronata* and *Z. leucophrys,* as well as with those of Wolfson (1952) on the Slate-colored Junco (*Junco hyemalis*), and, apparently also, with those of Schildmacher (1938) on the European Redstart (*Phoenicurus phoenicurus phoenicurus*). In this respect it is interesting to note that Riley (1936) found young male English Sparrows (*Passer domesticus*) to be non-refractory in fall, an observation consistent with that of Davis (1953) who has reported cases of gonadal development among first-year English Sparrows in late spring. However, Vaugien (1952) has found young English Sparrows

Table 1

Experimental Groups

Group	Period of treatment	Total number	Adult males	1st–year males	Mean temperature in °C
A	Sept. 17–Oct. 22	9	1	2	25
B	Sept. 27–Oct. 31	12	2	4	22
C	Oct. 11–Nov. 14	12	1	4	18
D	Oct. 25–Nov. 28	12	3	6	15
E	Nov. 8–Dec. 12	12	2	6	15
F	Jan. 1–Feb. 4	15	6	6	10
Control	.....	8	3	5	....

to be refractory in summer. With respect to *Z. l. gambelii,* it still remains to be established whether there is an earlier period in which the young males will respond to increased photoperiod; here, the possibility of a pituitary response without an accompanying gonadal response should be considered. At present it can only be said that the young males in fall show refractoriness at least superficially identical with that of the adult males and that this refractoriness terminates at about the same time.

In the histologic aspects of our investigations we first studied a normal series of testes from wild-taken birds and from birds held in large cages under natural conditions of light and temperature. An ocular micrometer was used to obtain a series of measurements of seminiferous tubule diameters and diameters of nuclei of Leydig cells. These testes were found to conform closely with the description of testicular development in this race published by Blanchard and Erickson (1949). However, we were unable to delineate their stages 1 and 2 which differ only in the presence of Leydig cells in the latter. It is possible that our disagreement is a matter of what should be designated as Leydig cells. In wild specimens taken in fall we found scattered nuclei which, although somewhat smaller in diameter (3.5–4.1 micra compared to 5.5–6.0 micra in late winter and spring), otherwise resemble those of the Leydig cells as described by Blanchard (1941) and Blanchard and Erickson (1949). Certainly this is a matter which requires further investigation; very possibly the technique employed by Marshall (1951) would produce enlightening results. For the purposes of this paper we are retaining the stages of testicular development proposed by Blanchard (1941) except that we combine stages 1 and 2, designating this "combined" stage as 1–2. The histologic data from the experimental groups are summarized in table 2. The differences between the adult and first-year testes, both in the experimental and control groups (except in weight in fall and winter), are slight, as noted also by Blanchard and Erickson (1949) and consequently have not been treated separately.

Our data (table 2) indicate that the time at which refractoriness terminates, allowing for individual variations, comes during a period encompassing the last two weeks

of October and the first week of November. This is almost identical with the conclusion reached by Miller (1954:16).

Although our data are only suggestive, it appears possible that the refractory period in *Z. l. gambelii* may not be a single phenomenon. The basis for this suggestion is the apparently greater diameters of the nuclei of the Leydig cells without accompanying tubular responses in groups A, B, and C as well as in some of the individuals in group D compared to those of birds obtained in the wild during the same period (table 2). The mean of nuclear diameters of the Leydig cells from wild birds is significantly smaller

Table 2

Testicular Responses to 15-Hour Daily Photoperiods

Group	Weight response				Mean diameter *seminiferous* tubules in micra	Mean diameter *Leydig cell* nuclei in micra	Stage of testicular development[4]
	Positive[2]	Negative	Range; mg.	Mean			
A	0	3	0.8–1.8	1.3	54	4.1	1–2 only
B	0	6	0.8–1.6	1.1	45	4.0	1–2 only
C	0	5	0.6–3.0	1.4	58	4.5	1–2 only
D	3[2]	6[3]	1.2–50	16	62[5], 245[6]	3.9[5], 5.3[6]	6 in 1–2[5]; 2 in 4[6]; 1 in 5[6]
E	*8*	*0*	*17–140*	*47*	*226*	*5.3*	*7 in 4; 1 in 6*
F	*12*	*0*	*14–210*	*104*	*298*	*4.6*	*1 in 3; 3 in 4 5 in 5; 3 in 6*
Control	*0*	*8*	*0.4–3.6*	*1.7*	*49*	*3.8*	*1–2 only*

[1] Combined weights of both testes greater than 10 mg.
[2] 2 first-year, 1 adult. [3] 1 first-year, 5 adult.
[4] According to Blanchard (1941) except that stages 1 and 2 are not distinguished separately (see text).
[5] Negative weight response. [6] Positive weight response.

($P<0.05$) than the mean for those experimental birds in which the seminiferous tubules showed no ($P>0.05$) response. An alternative explanation, which could be studied experimentally, might be that of a slower response of the tubules to gonadotropins. However, since the development of the tubules and the development of the Leydig cells (Nalbandov, Meyer, and McShan, 1951) apparently involves different gonadotropic hormones, the possibility of separate states of refractoriness with respect to the production or release of individual gonadotropic hormones merits consideration.

Our observations of the plumage of the experimental birds show, with considerable individual variation in extent and pattern, a rather consistent molt response to the 15-hour daily photoperiods. Without regard to extent of the molt, and including both males and females, the positive responses were as follows: group A, 9 out of 9; B, 12 out of 12; C, 12 out of 12; D, 11 out of 12; E, 12 out of 12; F, 14 out of 15. We have found the prenuptial molt in wild controls and caged controls with natural daily photoperiods to begin in mid-March. These results are apparently similar to Miller's (1954) observations on a small series of *Z. leucophrys* and his (1948, 1954) extensive series of *Z. coronata*. There is certainly ample reason to believe, as Miller (1954) suggests, that this experimentally induced molt is not associated with the gonadal response. However, these data do suggest the possibility that the pituitary, although refractory with respect to the light-induced release of gonadotropic hormones, may not be refractory with respect to other light-induced functions, assuming, of course, that the pituitary is involved in the mechanism of the molt induced by increased daily photoperiods. Obviously the mechanism of the induction of this molt must be a subject of further research.

Because our experiments were designed primarily to ascertain the time of natural termination of the refractory period as indicated by testicular response, we unfortunately do not have data on fat deposition for direct comparison with the observations of Miller (1954). However, it may be of some interest to comment on trends in the weights of the experimental males. In considering these trends it is necessary to bear in mind that the relationship between changes in body weight and changes in the amount of fat deposited, as indicated by our unpublished data involving quantitative lipid extraction, is not necessarily a simple one. In general it may be said that groups A and B showed no real tendency toward increases in weight. In group C, in which there were no positive testicular responses, several of the birds showed an initial increase in weight of the order of 2 to 3 grams; in most of these there was a subsequent decline, often to a final weight lower than the initial weight, as the molt developed. In this respect it should be noted

Table 3

Body-weight Responses to 15-Hour Daily Photoperiods

Group	Initial weight; mean in grams	Greatest recorded increase in weight; mean in grams	Difference between final weight and initial weight; mean in grams
A	30.0	0	−1.0
B	25.9	−0.4	−1.8
C	28.4	2.0	−0.4
D[1]	29.4	0.7	−0.6
D[2]		1.7	−3.1
E	27.4	2.7	0.5
F	25.5	3.4	2.6

[1] Negative testicular response. [2] Positive testicular response.

(Farner, Mewaldt, and King, 1954) that both caged and wild birds under natural conditions do not show increases in weight in spring until after the conclusion of the prenuptial molt in late March or early April; there is a strong positive correlation between this increase in weight and the quantity of deposited lipids. The changes in weights in group D, for those with positive and negative testicular responses alike, were similar to those of group C. In groups E and F, particularly in the latter, the tendency toward increased weight appeared to be more pronounced and to persist more steadily throughout the 5-week period despite the development of the molt. These observations suggest the possibility that increased daily photoperiod may cause an increase in weight somewhat before the end of the refractory period, as indicated by testicular response, and that the effect of increased photoperiod, with respect to weight, may increase as a function of time after the end of the refractory period. They also suggest that molt and weight responses, which are sequential under natural conditions in spring, can develop simultaneously under experimental conditions.

CONCLUSIONS

On the basis of increases in testicular weights and tubular diameters in response to 15-hour daily photoperiods, it may be concluded that the refractory period in male *Zonotrichia leucophrys gambelii* reaches its natural termination, with individual variations, during the last two weeks of October and the first week of November. Apparently there are no essential differences between first-year and adult birds in this respect. A variable molt is usually induced by increased daily photoperiods in both refractory and non-refractory individuals.

LITERATURE CITED

Blanchard, B. D.
1941. The white-crowned sparrows (*Zonotrichia leucophrys*) of the Pacific seaboard. Univ. Calif. Publ. Zool., 46:1–178.

Blanchard, B. D., and Erickson, M. M.
1949. The cycle in the Gambel sparrow. Univ. Calif. Publ. Zool., 47:255–318.

Burger, J. W.
1949. A review of experimental investigations on seasonal reproduction in birds. Wilson Bull., 61:211–230.

Davis, J.
1953. Precocious sexual development in the juvenal English sparrow. Condor, 55:117–120.

Farner, D. S., and Mewaldt, L. R.
1952. The relative roles of photoperiod and temperature in gonadal recrudescence in male *Zonotrichia leucophrys gambelii*. Anat. Rec., 113:612–613.

Farner, D. S., Mewaldt, L. R., and King, J. R.
1954. The diurnal activity patterns of caged migratory white-crowned sparrows in late winter and spring. Jour. Comp. Physiol. Psych., 47:148–153.

Marshall, A. J.
1951. The refractory period of testis rhythm in birds and its possible bearing on breeding and migration. Wilson Bull., 63:238–261.

Miller, A. H.
1948. The refractory period in light-induced reproductive development of the golden-crowned sparrow. Jour. Exp. Zool., 109:1–11.
1954. The occurrence and maintenance of the refractory period in crowned sparrows. Condor, 56:13–20.

Nalbandov, A. V., Meyer, R. K., and McShan, W. H.
1951. The role of a third gonadotropic hormone in the mechanism of androgen secretion in chicken testes. Anat. Rec., 110:475–494.

Riley, G. M.
1936. Light regulation of sexual activity in the male sparrow (*Passer domesticus*). Proc. Soc. Exp. Biol. Med., 34:331–332.

Schildmacher, H.
1938. Hoden und Schilddrüse des Gartenrotschwanzes *Phoenicurus ph. phoenicurus* unter dem Einfluss zusätzlichen Belichtung im Herbst und Winter. Biol. Zentralbl., 58:464–472.

Vaugien, L.
1952. Sur le conditionnement des cycles sexuels du moineau domestique par la lumière naturelle et la lumière artificielle. Necessitè de l'obscurité temporaire. C. R. Acad. Sci. Paris, 254: 364–366.

Wolfson, A.
1952. The occurrence and regulation of the refractory period in the gonadal and fat cycles of the junco. Jour. Exp. Zool., 121:311–325.

Laboratories of Zoophysiology, Department of Zoology, State College of Washington, Pullman, Washington, and *Department of Biological Sciences, San Jose State College, San Jose, California, September 15, 1954.*

AVIAN MORTALITY FROM DDT IN CALIFORNIAN RICE FIELDS

By ROBERT L. RUDD and RICHARD E. GENELLY

Wildlife in the rice fields of the Sacramento and San Joaquin valleys of California is a valuable recreational and esthetic resource. In the valleys, plantings of rice have been increasing for several years, and in 1954 the total cultivated was approximately 350,000 acres. The constant water supply and abundance of food in rice fields allow the existence of dense bird populations. Of particular interest to the sportsman is the excellent hunting which results from concentrations of waterfowl and pheasants on these lands. Although application of chemicals to control noxious invertebrates is necessary to insure economically satisfactory production, conservationists feel that consideration must be given to possible undesirable effects on wildlife of such control measures. To serve the interests of both agriculturalists and conservationists we need to examine factors which disturb desirable recreational and esthetic values on these lands.

Recognition of the multiplicity of values of managed lands necessitates continuing examination of use of chemical controls in agricultural practice. Serious disturbances from such chemicals may result from carelessness or from lack of appreciation of the high toxicity of the newer control chemicals. A case in point is the sowing of DDT-coated seed rice. The chemical is applied to control tadpole shrimps and scavenger beetles which may damage seedling rice. With the intent of reducing operating costs, growers have combined the sowing and chemical control phases of rice culture. Reduction of costs is, of course, always desirable but it is also desirable to investigate the possibility of unfavorable ecological effects resulting from this method of applying chemicals.

Field reports on avian mortality in rice fields, at best, have been insufficiently documented. Some have been little more than "impressions." However, reports of bird loss in rice fields due to DDT have now been recorded from Glenn, Yolo, Sutter, San Joaquin, and Merced counties. Presumably, conditions of exposure are the same in the other rice-growing counties. From the field reports alone, it is difficult to conclude that no effect of the treated seed on birds exists.

We have investigated reports in San Joaquin and in Merced counties. The first of these concerned a pheasant in a delta rice field that was observed to exhibit the characteristic tremors of DDT poisoning. Several verbal accounts confirmed the reports of pheasant loss in this area. A rice grower near Merced, who was also an ardent conservationist, had originally reported significant bird losses on his own farmlands. He had found dead pheasants, ducks and blackbirds and had reported that "some" pheasants when approached appeared reluctant to run or fly and showed signs of incoordination.

On our first survey of the Merced field on May 5, 1953, we found ten dead Mallards (*Anas platyrhynchos*), one dead Ring-necked Pheasant (*Phasianus colchicus*) and one dead blackbird. The pheasant had died a short time previously and was in the same area where one was seen behaving strangely the preceding day. At autopsy, all birds showed empty crops and gizzards with the exception of the pheasant, in which there was rice in both crop and gizzard. The second trip to the same ranch on May 15, 1953, yielded four dead male Mallards. Crops and gizzards of all showed traces only of vegetable matter. One bird had extensive subcutaneous hemorrhage and none showed obvious injury.

The concensus of field reports is that a detectable mortality of birds occurs regularly during the sowing period (April to June). As a test of the likelihood of mortality in the field, it seemed desirable to determine experimentally the effect of DDT-treated rice on caged pheasants and ducks. The results of feeding experiments with six male Pin-

tails (*Anas acuta*) and twelve pheasants of both sexes are indicated in table 1. Rice treated at the rate of one and one-half pounds of DDT (three pounds of a 50 per cent wettable powder) per 100 pounds was offered *ad libitum* to experimental birds. This value is equivalent to 15,000 parts per million DDT in the diet. In other studies, values as low as 400 parts per million in the diet have caused death. All birds were caged in outdoor pens at the University of California in Davis. Normal feeding was resumed after 11 days with the remaining test pheasants and after 15 days with remaining ducks.

Results of Feeding DDT-Treated Seed Rice to Ring-necked Pheasants and Pintail Ducks

Number and sex	Weight in grams			Time in days			Remarks
	At dosing	Terminal	Change	Interval between weights	Dosing to 1st observed symptom	Dosing to death	
Pheasants							
562 ♀	938	891	—47	19	....	(survived)	no symptoms
563 ♀	901	865	—36	19	....	(survived)	no symptoms
567 ♀	869	836	—33	19	4	(survived)	slight incoordination
573 ♀	836	762	—74	19	....	(survived)	no symptoms
586 ♀	801	740	—61	19	6	(survived)	slight tremors
981 ♀	943	830	—113	13	4	5	severe tremors
574 ♂	1176	1036	—140	13	4	5	severe tremors
577 ♂	1287	1110	—177	13	3	5	severe tremors
528 ♂	1115	1057	—58	19	....	(survived)	no symptoms
719 ♂	1208	1001	—207	18	....	10	no symptoms
720 ♂	1234	1125	—109	19	....	(survived)	no symptoms
721 ♂	1213	1028	—185	12	3	4	severe tremors
Ducks							
102 ♂	995	953	—42	35	....	(survived)	no symptoms
108 ♂	797	599	—198	30	13	13	visceral hemorrhage
114 ♂	1045	862	—183	35	....	(survived)	no symptoms
141 ♂	882	669	—213	32	13	15	mild tremors
147 ♂	946	702	—244	32	14	15	severe tremors
197 ♂	831	678	—153	35	....	(survived)	weakened

Pheasants did not begin to resist the diet until symptoms were well advanced. Ducks, however, appeared reluctant to eat the treated grain after two or three days of exposure. All birds registered losses in weight (see table). Histological preparations of the liver of two birds (nos. 574 and 721) revealed slight fatty degenerative changes characteristic of chlorinated hydrocarbon intoxication. Most specimens at autopsy showed some visceral hemorrhaging and one (no. 577) had numerous small subcutaneous hemorrhages. This subcutaneous congestion was similar to that found in a wild Mallard.

The pattern of mortality clearly shows that male pheasants are more susceptible to the chemical than are females. Greater sensitivity of male pheasants to DDT has also been noted in our other studies.

Although results from pen experiments may not be applied directly to field conditions, the combination of field reports and controlled experimentation in this instance makes it clear that DDT-treated grain is or can be lethal to grain-eating birds. This mortality may be entirely eliminated by applying chemical and seed separately. There is some indication that application of chemical after germination yields more effective pest control. In recognition of this, many growers have already begun to apply DDT a week or two after sowing.

Acknowledgment.—This study was supported by the Federal Aid in Wildlife Restoration Act, Project California W45-R.

University of California, Davis, California, November 24, 1954.

FROM FIELD AND STUDY

Calliope Hummingbird Entangled in Grass Barbs.—An interesting and possibly unusual tragedy occurred recently when an adult Calliope Hummingbird (*Stellula calliope*) became entangled in barbs of a spike of grass, *Setaria verticillata*, growing in the garden of Professor J. H. Roblyer at the College of Idaho (fig. 1). The breast feathers were entwined about the head of grass. The small barbules of the awns held so firmly that the bird was helpless and unable to pull itself away. It had been dead some time when found by Mrs. Roblyer. The specimen was received July 15, 1954, at which time the grass was quite mature.—HAROLD M. TUCKER, *College of Idaho, Caldwell, Idaho, October 15, 1954.*

Fig. 1. Calliope Hummingbird entangled in grass barbs.

Glossy Ibis in Oklahoma.—On May 13, 1954, at the Federal Fish Hatchery near Tishomingo, Johnston County, Oklahoma, James H. Pratt shot a well plumaged adult Glossy Ibis (*Plegadis falcinellus*) which had no white on the forehead or face. It was a solitary bird. Kermit E. Sneed, of the Sulphur Fish Hatchery, Sulphur, Oklahoma, eviscerated the specimen and courteously brought it to me. I skinned it out as soon as possible, but was unable to sex it. It was not very fat.

So far as I know this is the first Oklahoma specimen of *P. falcinellus* to have been preserved. It is no. 1280 in the new bird collection of the Museum of Zoology at the University of Oklahoma. In discussing the record with Mr. Sneed, I learned from him that in May, 1951, a well-driller had killed

seven adult Glossy Ibises on the ponds of the Red River Fisheries, near Grant, Choctaw County, Oklahoma, and that four of these had had no white on the face. The seven birds had all been in the same flock.

The White-faced Glossy Ibis (*P. mexicana*) has been recorded many times during recent years in Oklahoma. Mrs. Nice ("The Birds of Oklahoma," 1931:58) listed the species as "accidental" and mentioned a specimen taken near Dover, Kingfisher County, in 1897. John B. Semple collected an adult male specimen three miles south of Gate, Beaver County, on May 18, 1937. Our University bird collection has two specimens, both adults, one taken May 8, 1953, from a flock of sixteen birds at the Byron Fish Hatchery, Alfalfa County, by Clyde Burleson; the other taken by Cecil Nation, at the Red River Fisheries in Choctaw County, May 29, 1954.

No Glossy Ibis of either species has, so far as I know, ever been known to nest in Oklahoma. Though I continue to suspect that *mexicana* may prove to be a color-phase of *falcinellus*, I must admit that the coloration of the above-discussed specimens now in our collection corroborates Wetmore's statement (Auk, 68, 1951:525-526) to the effect that the shade of green in the wing plumage of *falcinellus* is oily and dark while that of *mexicana* is brassy. The difference is especially noticeable in the primary coverts.—GEORGE MIKSCH SUTTON, *Oklahoma Biological Survey, University of Oklahoma, Norman, Oklahoma, November 11, 1954.*

A Winter-active Poor-will.—The interest aroused by Jaeger's observations (Condor, 51, 1949: 105) on hibernation in the Poor-will (*Phalaenoptilus nuttallii*) makes the following observation noteworthy. At the Crown Ranch (elevation 1500 feet) in the Santa Ana Mountains south of Corona, California, on January 30, 1953, a single Poor-will was seen at 3 p.m. It could be approached within 10 feet before taking flight and would fly for about 10 seconds before again landing on the ground. It stayed within an area not greater than 25 yards square in a chaparral creek bottom. The air temperature was 60°F. No insects were apparent even after a cursory search.—NORMAN H. MELLOR, *Corona, California, August 17, 1954.*

Some Recent Arizona Bird Records.—In the period from September, 1951, to September, 1953, I accumulated a number of records bearing on the distribution of birds in Arizona. Many of these are from the Roosevelt Lake region of the central part of the state. I wish to express my appreciation to the Arizona Game and Fish Commission for providing collecting permits and for their cooperation and to Allan R. Phillips for identification of specimens here reported and for advice in preparation of this manuscript.

Pelecanus occidentalis. Brown Pelican. An emaciated immature male was found on a lawn in Goodyear, Maricopa County, on August 5, 1953, and presented to Abe Margolin, biologist at Phoenix College. The specimen measured as follows: wing chord, 570; culmen, 345. It is therefore referable to the western race *californicus*.

Mycteria americana. Wood Ibis. On August 23, 1953, this species was seen at a cattail marsh along the Salt River, one-half mile south of Paloverde, Maricopa County. At one time forty-nine were counted in the air. This is an exceptional number for central Arizona.

Aix sponsa. Wood Duck. A male was taken on January 17, 1953, near Tucson. It is the first specimen for southern Arizona. In view of the fact that Wood Ducks are raised commonly in captivity, it should be noted that there were no indications that this bird had been a captive. Its feathers were in perfect unworn condition, and its bill, legs, and feet were free from scales or diseased areas. A second male was seen at Arivaca, Pima County, on February 23, 1953.

Aythya marila. Greater Scaup. A partial skeleton was found at Picacho Reservoir, south of Coolidge, Pinal County, on January 31, 1953. Measurements of the bill and nail, and of the wing, plus color characteristics of the remaining primaries were sufficient to identify the species. This is the second verified record of the species for the state, although hunters have reported taking "big scaup ducks," and they are undoubtedly more common than records indicate. Picacho Reservoir is heavily hunted, and the bird found was presumably a cripple which had been eaten by scavengers.

Lophodytes cucullatus. Hooded Merganser. An immature male was observed on Tonto Creek, one mile north of Roosevelt Lake, Gila County, on November 17, 1951, and a female was flushed from some flooded *Tamarix* along the lake shore on April 5, 1952.

Accipiter gentilis. Goshawk. On February 12, 1953, I was attempting to "squeak up" Red Cross-

bills on Mount Lemmon in the Santa Catalina Mountains. An adult female Goshawk responded to my squeak and lit in the tree over my head. I collected the bird, and by its large size and dark dorsum it proved to be referable to *A. g. apache*. It is the first record for the species from the Santa Catalina Mountains and the northernmost record of the race *apache*.

Rallus limicola. Virginia Rail. An immature male taken at a slough along the Salt River several miles west of Phoenix on August 22, 1953, is the earliest fall record for the state. The species is not known to breed in the lowlands of southern or central Arizona.

Caprimulgus vociferus. Whip-poor-will. On November 4, 1952, I picked up a very dark male Whip-poor-will dead on the road four miles south of Roosevelt, Gila County. This is the first specimen taken between October and April in Arizona. Comparison with specimens from the collections of Cornell University, American Museum of Natural History, and Donald R. Dickey showed it to be similar to specimens from El Salvador of the eastern race *vociferus*, a subspecies not previously taken in Arizona.

Sphyrapicus varius. Yellow-bellied Sapsucker. A dark red-headed sapsucker with an almost solid black back was taken in the bottomlands along Sonoita Creek, three miles southwest of Patagonia, Santa Cruz County, on February 2, 1953. It was identified as probably *ruber* by T. R. Howell and is the second record of that race for Arizona.

Corvus brachyrhynchos. American Crow. A flock of about twenty crows was seen on several occasions about the north end of Roosevelt Lake in February and March of 1952. Two adult males were taken from this flock on March 20. One (wing chord 317, tail 177) was identified as *hesperis;* the other was larger (wing chord 335, tail 188) and was determined to be *hargravei*, the race breeding in Arizona. I saw and heard a pair of crows in the same vicinity on April 13, 1953. This is the second record of crows occurring at this locality during the breeding season. It is an area of cottonwoods and willows along Tonto Creek, in the Lower Sonoran Life-zone. The normal breeding range of the crow elsewhere in Arizona is in the Transition Life-zone.

Hylocichla guttata. Hermit Thrush. A very pale bird taken six miles southwest of Roosevelt, Gila County, on April 9, 1952, is the northeasternmost record of *H. g. slevini* in the state.

Hylocichla ustulata. Swainson Thrush. A juvenile molting into first-winter plumage was taken at Jack Smith's Cabin, in the cork-bark fir belt of the San Francisco Peaks, Coconino County, on August 29, 1953. This is the locality where Phillips (Condor, 49, 1947:122) reported hearing them earlier in the summer. It is the first breeding record for this thrush in Arizona and the only record for northern Arizona of the controversial subspecies *almae*, which was previously considered merely accidental in the state.

Cassidix mexicanus. Boat-tailed Grackle. A first-year male, as determined by plumage, was taken at Apache Lake, Maricopa County, on May 10, 1952. This is to date the northernmost and westernmost record of the large, slender-billed race *monsoni*.

Euphagus cyanocephalus. Brewer Blackbird. A heavily molting male was taken just west of Phoenix on July 26, 1953. Its testes measured 3 and 4.5 millimeters. The record is interesting for the date involved.

Piranga rubra. Summer Tanager. The first tanagers along Rock Creek (eight miles northwest of Roosevelt) in 1952 were seen April 20, when two males were taken. One (RWD 572) was of the local breeding race, *cooperi*, while the other (RWD 573) was a first-year male (the molt into first breeding plumage nearly complete) of the eastern form *rubra*. This is the third specimen of *rubra* for the state.

Loxia curvirostra. Red Crossbill. An adult male and two accompanying juveniles, with bills just beginning to cross, were collected on February 26, 1953, on Mount Lemmon, in the Santa Catalina Mountains. This is the first breeding record of the Red Crossbill for that range.—ROBERT W. DICKERMAN, *Arizona Co-operative Wildlife Research Unit, University of Arizona, Tucson, Arizona, October 28, 1954.*

Black Scoters Reported from Baja California.—As I have seen all three species of scoters along the northwestern coast of Baja California and as all three have been reported wintering south to San Diego County, California (Grinnell and Miller, Pac. Coast Avif. No. 27, 1944: 89–91), it is surprising to find no record of the Black Scoter or American Scoter (*Oidemia nigra*) from Baja California or elsewhere in México. It is not included in the treatises by Grinnell (Univ. Calif. Publ. Zool., 32, 1928:77), by Friedmann, Griscom, and Moore (Pac. Coast Avif. No. 29, 1950:45), or by Blake

(Birds of Mexico, 1953:58–59). Two definite records of this species are for 3 to 4 miles and 6 to 7 miles south of the mouth of Río Vicente (or Río San Isidro), respectively, on April 10 (one male, alone), and on August 8, 1954 (several males, in a raft of scoters including also at least one male Surf Scoter). On each occasion the birds were at rather close range in the surf.

The occurrence of this cool-water species in Baja California was to be expected, as the inshore temperatures of the northern part of the outer coast of Baja California are generally lower than those encountered along most of the southern California shoreline. Because of the cool upwelled water, many marine organisms of various groups that reach the San Diego region, and even some that skip that warmer area, are being found to occur in Baja California, and it is to be anticipated that nearly all of the northern types that reach the San Diego area will eventually be found to occur in the cooler stretches of the coast of northwestern Baja California.

The record of August 8 is much earlier than any reported from California, according to the listing by Grinnell and Miller (Pac. Coast Avif. No. 27, 1944:90–91). Their summary of the known records encompasses the months from November to April. It is possible that the August bird, like a few Surf Scoters and a few White-winged Scoters, was a non-migrating individual—CARL L. HUBBS, *Scripps Institution of Oceanography, University of California, La Jolla, California, November 8, 1954.*

Taxonomic Comment on Races of Leach Petrel of the Pacific Coast.—Several years ago A. J. van Rossem described (Proc. Biol. Soc. Wash., 55, 1942:10) a new subspecies of the Leach Petrel, *Oceanodroma leucorhoa,* from the Los Coronados Islands, off the coast of Baja California, under the subspecific name *willetti.* He compared it with the other Pacific coast races of *leucorhoa,* that is, with *beali* and *chapmani,* and also with *socorroensis,* which he considered to be also a race of *leucorhoa.* It was said to differ from *chapmani* of San Benito Island in its slightly lighter and distinctly more plumbeous body coloration, in its paler and more variably white upper tail coverts and in its slightly larger size. In the Carnegie Museum there are 34 specimens from the Los Coronados Islands that presumably represent the race *willetti.* I must confess my inability to distinguish them satisfactorily from our series of 44 specimens from San Benito Island—topotypes of *chapmani.* Only one of our Los Coronados specimens shows any great amount of white on the upper tail coverts; a few others have some white feathers. The body coloration is the same as in the San Benito birds so far as I can see, although it may be that freshly collected specimens might show a difference. The difference in size is inconsequential, as may be seen by consulting Loomis' table of measurements (Proc. Calif. Acad. Sci., ser. 4, 2, 1918:168–169). Thus only the color of the upper tail coverts is left as a differential character, and this would serve to distinguish not more than one out of five specimens. Therefore I cannot see how a case can be made out for *willetti.* Moreover, two of our San Benito specimens show traces of white on the upper tail coverts.

So I concluded a few years ago. Subsequently van Rossem, at my request, sent me 20 of his specimens from the Los Coronados Islands. My first step was to compare these with our series from the same islands, to discover if there had been any color change in the fifty years since ours were collected. Apparently there has been none. I have re-examined our material in connection with his, bearing in mind the points of difference which he specified, but I still fail to make out any differences which I would consider of subspecific value. Were the labels removed, it would be impossible, in four out of five cases, to refer a given specimen to one or the other race. Van Rossem sent me his measurements, as follows:

25 *willetti* ♂ ♂, wing, 146–161 (152.1); tail, 74–88 (81.6); bill, 14.2–17.5 (15.6).

25 *chapmani* ♂ ♂, wing, 138–154 (148.5); tail, 70–82 (76.9); bill, 14.7–16.0 (15.3).

These figures, overlapping as much as they do, in my opinion fail to justify a formal separation by name of the two populations. The photographs van Rossem sent me were not any more convincing. —W. E. CLYDE TODD, *Carnegie Museum, Pittsburgh, Pennsylvania, November 15, 1954.*

Nesting of European Starling in Western Montana.—On May 15, 1943, Mills (Condor, 45, 1943:197) observed the first nesting of the European Starling *(Sturnus vulgaris)* in Montana. This was near Havre in Hill County, central Montana, at the frontier of the westward-expanding breeding range of the species at that time (see Kessel, Condor, 55, 1953:64). The following is apparently the first record of nesting west of the continental divide in Montana.

On May 23, 1954, about 6 miles west of Dixon in Sanders County, along a half-mile of narrow

cottonwood stream border, I observed 12 to 15 Starlings betwen 9 and 11 a.m. Here I saw a male Red-shafted Flicker *(Colaptes cafer)* fly to a nest hole at the top of a dead cottonwood trunk. He was promptly displaced by a male starling, carrying food, who entered the hole, then turned around and looked out. It was a sharply cut aperture, probably of this year's excavating by a flicker. The flicker remained for the next half hour in the neighboring cottonwood tree, 12 to 15 feet distant, and called repeatedly, but it did not come into the nest tree again. The male starling continued to stand guard while I was there. He was not otherwise belligerent toward the flicker. Probably the issue had been settled some time before.

The female starling, carrying food but growing wary as I watched, retired to a distant tree top and several other starlings gathered with her there, evidently in response to her agitation. Finally she returned to the dead cottonwood top, hopped about for some time, and then departed without food. Again she came with insects and left without them. I had changed my seat to one in sight of a second hole 8 feet below, but she had not entered either nest hole. On circling the tree, a third, older, ragged-edged flicker hole was disclosed on the opposite side, 18 inches below the first. She returned a third time with a large billful of angle worms and soon entered this hole, appearing at once without them. I saw her bring food four more times at intervals of 6 to 8 minutes. The nest was about 35 feet up in the cottonwood.

Three Tree Swallows also came and hovered a few inches in front of the upper nest hole to which the flicker had come, but they never alighted. The male starling was always nearby. Once when the flicker came very near, the female starling gave a warning cry at the nest entrance and the male came closer to her.

It would seem that the flicker had been driven from his newly-excavated nest hole in the dead cottonwood top, or that at least the tree had been preempted by the starlings before the flicker's spring-time return.—JOHN L. BLACKFORD, *Libby, Montana, June 6, 1954.*

Another Blue-footed Booby in Southern California.—An immature booby was found at Paloma Street and North Foothill Boulevard in Pasadena, California, on the night of September 17, 1954, by Mrs. Roberta H. Rumble. The bird was exhausted and apparently in a dying condition. It was given water and a small trout, and by the next day it appeared fully recovered. We put it in a large flying cage where it promptly perched on the back of a large desert tortoise and rode around contently all day. It only slipped off to refresh itself with a dip in a large tub of water and to nibble on the tortoises' lettuce. It accepted a half cup of mosquito fish which it captured itself in the water dish. The bird was checked for identity by Jean Delacour of the Los Angeles County Museum and was determined to be *Sula nebouxii*, the Blue-footed Booby. There are three previous records of this species for southern California, the most recent in 1934 (see Pac. Coast Avif. No. 27, 1944:52).—ALMA STULTZ, *Audubon Center of Southern California, El Monte, California, November 23, 1954.*

Great Swallow-tailed Swift in Michoacán, México.—Prior to 1951 the Great Swallow-tailed Swift (*Panyptila sancti-hieronymi*) was recorded only from the mountains of western Guatemala, where six specimens had been collected. In that year, Carr and Dickinson (Wilson Bull., 63, 1951:271–273) reported nine specimens from south-central Honduras and a sight record made by Griscom and Miller in north-central Nicaragua in 1917. More recently the known range was extended to extreme southern México by Alvarez del Toro (Condor, 54, 1952:113–114), who obtained a specimen at Tuxtla Gutiérrez, Chiapas. A smaller species, *Panyptila cayennensis*, which occurs locally in the lowlands from eastern Honduras south to southern Brazil, is known in México from the unique type of *P. c. veraecrucis* from Presidio, Veracruz (Moore, Proc. Biol. Soc. Wash., 60, 1947:143–144).

On June 6, 1954, I collected a specimen of *P. sancti-hieronymi* at a point 3.5 miles northwest of Tzitzio, 6500 feet, Michoacán, México, on the road leading south from the Mexico City-Guadalajara highway to Huetamo. This individual was one of five to eight birds of this species that circled low over my camp in the late afternoon in association with another, smaller swift (probably *Cypseloides niger*) and several unidentified swallows. The locality has been described by Davis (Condor, 55, 1953: 90–98) in connection with a report of the birds of the Tzitzio region. It is a region of slopes and ridges where dry pine-oak forest mingles with leguminous thorn-scrub elements invading upward from lower elevations to the south. Near the highway, four or five miles northwest of my camp site, there is a series of vertical cliffs.

The Michoacán specimen (see fig. 1) is an adult female in a late stage of molt. The rectrices, secondaries, secondary coverts, some upper middle and lesser primary coverts, marginal coverts of the forearm, distal coverts of the manus, primaries 2 to 4 and 6 to 8 and their greater coverts, and most of the body feathers are new and unworn. The upper tail coverts and a few feathers in the sternal region are ensheathed basally; primaries 5, 9, 10 and their corresponding greater coverts are old; primary 1 on either side is missing; and the alulae are old. A brood patch was present but, presumably, it was old since the skin was not edematous and the bare patch was crossed on either side by a line of small, new feathers. The ovary measured 7.2 mm. in length and contained no enlarged ova; the oviduct was not enlarged. These data on molt, and condition of gonad, oviduct, and brood patch suggest that the bird had bred earlier in the season.

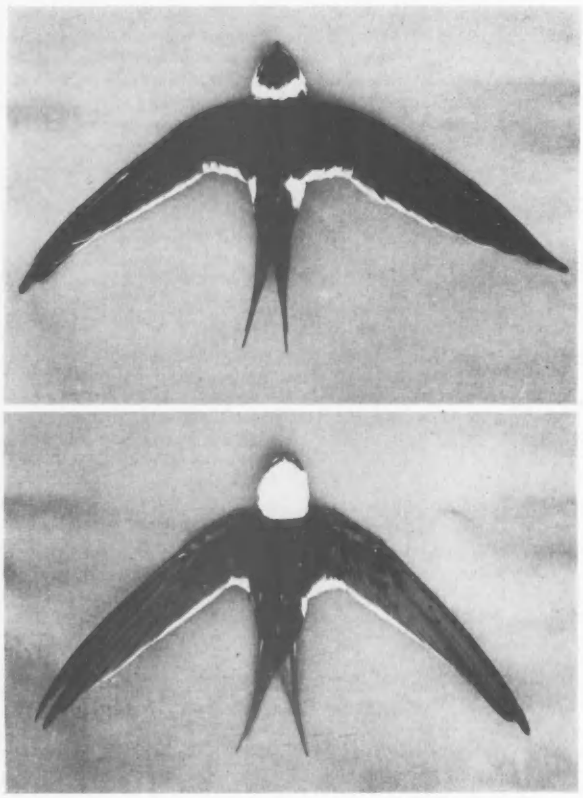

Fig. 1. Dorsal and ventral views of Great Swallow-tailed Swift taken in Michoacán.

Dr. Josselyn Van Tyne and I compared this specimen with examples of this species from Honduras in the Museum of Zoology of the University of Michigan, from which it differs in no significant way. It measured as follows: wing, 190.0 mm., tail, 92.7, exposed culmen, 6.9, weight, 49.3 gm.

The call notes of this swift have been compared to those of a chick (Alvarez del Toro, *loc. cit.*). Several *peep* or *peet* sounds given by these birds as they circled above my camp were similar to the call notes of the Booming Nighthawk (*Chordeiles minor*), but they were less nasal and higher pitched.

The occurrence of this large swift in Michoacán represents an extension of known range of over 500 miles and the first record north of the Isthmus of Tehuantepec. Its seasonal status in Michoacán is unknown but quite probably it will be found to breed locally in mountainous areas.—ROBERT K. SELANDER, *Museum of Vertebrate Zoology, Berkeley, California, October 26, 1954.*

The Nighthawks of the Tamaulipas Coast of México.—Warner and Mengel (Wilson Bull., 63, 1951:292) in their useful paper on the birds of the Veracruz coastal plain discussed two specimens of Nighthawk (*Chordeiles minor*) from the coast of southern Veracruz, México. One of these, a breeding female collected by Charles H. Rogers in 1930 had been identified as *C. m. chapmani* by H. C. Oberholser, Rogers, and Frederick W. Loetscher, Jr.; the second specimen, an immature female, was identified by Alexander Wetmore as *aserriensis*, although he indicated that its color was not typical of that form. Warner and Mengel suggested that the nighthawks of the Veracruz coast represented either *aserriensis* or an undescribed subspecies, but *not chapmani*. The distribution of *Chordeiles minor* in México has been summarized by Selander and Alvarez del Toro (Condor, 55, 1953:160–161).

In the summer of 1953 I collected four specimens (adult males) of this species which shed considerable light on the identity of the nighthawks of the southern coastal area of Tamaulipas, México. Two of my specimens (RRG 2260 and 2254) were taken 4 miles southeast of Loma del Real in southern Tamaulipas on June 19, as they "zoomed" over salt flats near the beach in the typical courtship flight of the species. They weighed 68 and 69 grams, respectively. Neither was fat. Both had slightly worn plumage and enlarged testes. I have no doubt that they were breeding birds. They measured: wing chord, 183 and 188; tail, 101 and 102 mm., respectively. The other two specimens (RRG 2436 and 2438) I collected on August 3, about 9 miles south of La Carbonera in northern Tamaulipas. They weighed 68 and 70 grams. Neither was fat. Both were in somewhat worn plumage and had enlarged testes. They also were probably breeding birds. The two measured: wing chord, 186 and 192; tail, both 104 mm. All these specimens fall within the size limits of *chapmani*, and three of the four fall within the limits of both *chapmani* and *aserriensis* as given by Oberholser (U. S. Nat. Mus. Bull., 86, 1914:71, 75), hence their identification is based on color characters (see fig. 1).

It is clear from these specimens that the nighthawks of the northern and southern Tamaulipas coastal areas are not of the same form. The two northern birds are whiter and much less heavily barred below and less heavily mottled with dark dorsally than either of the southern birds. As the locality would indicate, they are representative of the form *aserriensis* and compare well with specimens of that race from Terrell County, Texas. The two southern specimens, on the other hand, approach specimens of *chapmani* from Georgia in the reduction of white and increased dark pigmentation in all parts. Oberholser (*op. cit.*: 29) pointed out the duplication of certain characters in geographically widely separated races of this species. In accordance with Gloger's rule, members of the species tend to be darker in areas of higher humidity and lighter in those of aridity. The ecology of the species would appear to be much the same along the entire coast, because where *Chordeiles minor* occurs, salt and sand limit the vegetation type and growth to a large extent. There is, however, a marked difference in annual precipitation between southern and northern coastal Tamaulipas. It is not surprising, then, to find darker birds in the more humid south. The birds of southern Tamaulipas are separable, however, from specimens of *chapmani*. They differ in having narrower ventral barring, in being buffier in all parts (to this extent suggesting *henryi* slightly), and in having additional light mottling dorsally, including the wings.

These Tamaulipas specimens which are clearly neither *aserriensis* nor *chapmani*, although more like the latter, show why the breeding female from southern Veracruz was called *chapmani*. Mr. Rogers kindly sent that specimen to me and I have carefully compared it with females from Georgia and Louisiana which show the characters of *chapmani*. The Veracruz bird is quite worn and slightly smaller (wing chord, 172; tail, 96 mm.) than the smallest measurement given for female *chapmani* by Oberholser (*loc. cit.*), but in color and pattern it matches birds from the United States very well, differing only in its slightly darker wing coverts (possibly due to wear) and smaller white patch on the outermost primary. The specimen does not represent the southeastern race of the United States,

but a *chapmani*-like form which has not so far as I know been named. Presumably it is of the same race as the distinctive southern Tamaulipas males, but I have neither specimens of males from Veracruz nor Tamaulipas females with which to determine this.

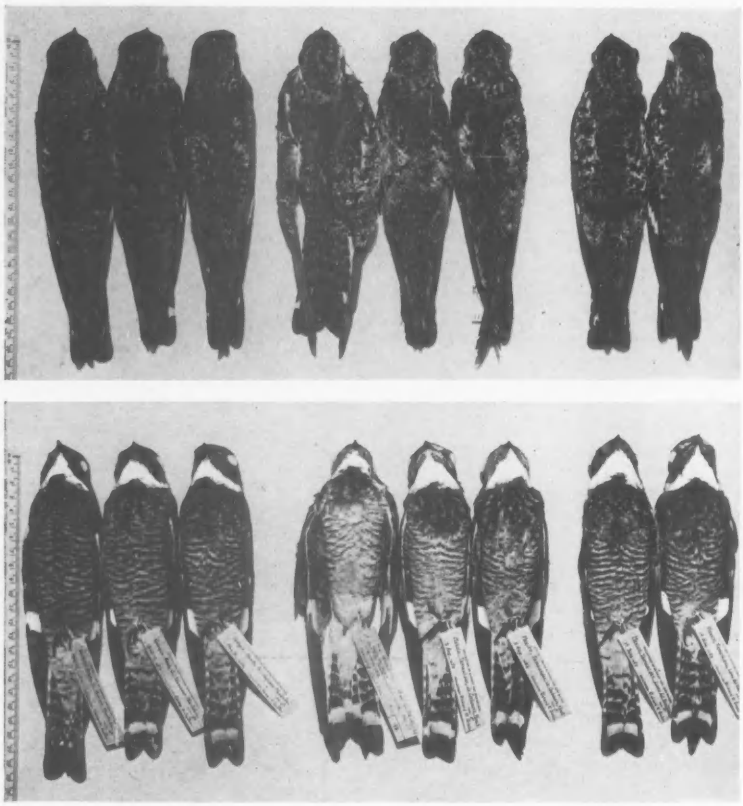

Fig. 1. Dorsal and ventral views of *Chordeiles minor* showing variation in areas of different humidity. Left to right: three *C. m. chapmani* from Georgia, three *aserriensis* from southern Texas and northern Tamaulipas (RRG 2436, 2438), and unnamed form from southern Tamaulipas (RRG 2260, 2254). Note variation in amount of white on outer web of rectrix.

Although I strongly suspect that the birds of southern Tamaulipas warrant nomenclatural recognition, it seems advisable to wait for additional material to be collected. The color variation may occur as a smooth cline (pale-north to dark-south), but it is probably comparable to the variation between eastern *chapmani* and *aserriensis*.

I wish to thank Mr. Rogers of the Princeton Museum of Zoology, Dr. W. Frank Blair of the University of Texas, and Dr. George M. Sutton for the use of comparative material from collections in their charge.—RICHARD R. GRABER, *Museum of Zoology, University of Oklahoma, Norman, Oklahoma, October 6, 1954.*

NOTES AND NEWS

Don R. Eckelberry has contributed a series of exceptionally instructive and artistic original drawings to illustrate his article on Mexican birds that appears in this issue.

Members may still make arrangements to attend the Twenty-fifth Annual Meeting of the Cooper Ornithological Society at Asilomar, Pacific Grove, California, April 21 to 23.

The valuable and extensive article on winter societies in juncos has been printed with the aid of a financial contribution from the author.

The work of the Treasurer of the Cooper Ornithological Society will be greatly lightened if members will send in their dues promptly upon receiving annual notices.

PUBLICATIONS REVIEWED

A History of Birds. By James Fisher. Houghton Mifflin Company, London, Boston, 205 pp. November 9, 1954. $3.75.

Among the British ornithologists of these days, Mr. Fisher is an excellent popular writer; that is to say that he can successfully give to the reading public in a pleasant and easily understood language a good idea of our scientific knowledge of birds as it now stands. The present work is a new and considerably improved version of his "Bird as Animals" (1939). During the last fourteen years the understanding of bird life has greatly increased and so has the experience of the author.

In his first three chapters he reviews the works of the principal bird historians of the manuscript age and of the printing age, both as students of British birds and of world-wide ornithology. The following eight chapters deal with systematics, geographical distribution, bird history, speciation, the numbers of birds, absolute and comparative, and changing populations. There is a good bibliography and a useful index.

On the whole, Mr. Fisher's treatment of the subject is sensible and satisfactory and we can recommend this work as an introduction to the study of birds. As the subtitle points out, it is a concise study of the development of birds and their relationship to man.—Jean Delacour.

Bird-ringing, the Art of Bird Study by Individual Marking. By R. M. Lockley and Rosemary Russell. Crosby Lockwood, London, viii + 119 pp., 55 figs. and 8 pls., with 17 halftones. Price, 9s. 6d.

Here is a small handbook useful to bird-banders and other students of birds faced with problems of marking birds. Details regarding materials and techniques are presented, not from the standpoint of bird-banding as an end in itself, but as an aid in study of life-history, migration, and homing. The topics of the five chapters are history, research values, techniques of handling and marking, techniques of trapping, and lastly advice on bands, records, and field equipment. There are three appendices. The first sets forth 50 questions which offer appropriate bases to start the novice in a serious life-history study by the ringing method; the second lists British bird observatories and describes their organization; and the third is a two-page bibliography of selected titles.

This description, brief though it is, should serve to recommend the book to all those making use of banding techniques. It is compact, well organized, and distinctly useful, particularly to beginners, but also to the more experienced who may be interested in a review of British practices. —Frank A. Pitelka.

COOPER SOCIETY MEETINGS

NORTHERN DIVISION

November.—The monthly meeting of the Northern Division was held on November 4, 1954, at the University of California, Berkeley. Robert I. Bowman proposed Richard W. Russell for life membership and James D. Anderson for regular membership; both new members are associated with the Museum of Vertebrate Zoology, Berkeley.

President Reynolds urged the members of the Northern Division again to write to their senators and representatives regarding preservation of the national parks. Donald McLean noted that plans are being considered for the expansion of industrial lands onto portions of the Alviso marshes, in Santa Clara County, California. He suggested that the Cooper Society or other groups interested in conservation lease or pur-

chase a small plot of marsh land in order to establish a preserve for the Clapper Rail and other marsh birds.

William W. Dunmire presented an illustrated lecture: "Into the Nepal Himalayas with the California Makalu Expedition."—ROBERT K. SELANDER, *Secretary*.

SOUTHERN DIVISION

NOVEMBER.—The monthly meeting of the Southern Division was held on November 30, 1954, at the Los Angeles County Museum. The following names were proposed for membership: Stuart Altmann, 9901st TU, WRAMC, Washington 12, D.C., by Thomas R. Howell; Donald De Vries Shipley, Dept. Natural Science, Long Beach State College, Long Beach, Calif., by M. D. Arvey; Alan Wilson Vaughan, 1808 Duchess Ave., West Vancouver, B.C., Canada, by Jack von Bloeker, Jr., A. Houston Barnett, 341 C. Canon Dr., Beverly Hills, Calif., Richard W. Castenholz, Botany Dept., State College of Washington, Pullman, Wash., Ralph M. Edelburn, Marshall College, Huntington, W. Va., Mrs. Paul D. Dodds, 749 Longwood Ave., Los Angeles 5, Calif., Robert H. Rhodes, 2914 Clume Ave., Venice, Calif., and Robert L. Salter, 711 Shoshone St., Boise, Ida., all by C. V. Duff.

Dorothy Groner reported having seen a flock of 22 Evening Grosbeaks and 6 Golden-crowned Kinglets at Buckhorn Flat, Los Angeles County, on November 28. M. Dale Arvey told of a Summer Tanager seen at Recreation Park, Long Beach, on November 22. Robert Hannum reported through Kenneth Stager that on September 1, 6 Starlings had been seen just west of Rosamond, California.

Kenneth E. Stager presented a comprehensive account of his recent activities, entitled "Ornithological Investigations in Tropical Australia," illustrated with Kodachrome slides and study skins.—DOROTHY E. GRONER, *Secretary*.

JANUARY.—The monthly meeting of the Southern Division was held on January 25, 1955, at the Los Angeles County Museum. The following names were proposed for membership: Mrs. A. J. Argante, 1404 La Sierra Dr., Sacramento 21, Calif., by Francis H. Boynton; Donald E. Burton, 171 Strathearn Rd., Toronto 10, Ontario, Canada, by Jim Woodford; Duane Carmony, 223 S. Bryan, Bloomington, Ind., and Ormond Mitchell, P. O. Box 485, Lakeside, Calif., by Jack von Bloeker, Jr.; Harald N. Johnson, M.D., P. O. Box 429, Berkeley 1, Calif., by Junea W. Kelly; Vera Fay Lester, 415 Delno Ave., Fresno 1, Calif., by Dorothy E. Groner; Earl Kingston Lindley, 1994 Queensberry Rd., Pasadena, Calif., by Ed N. Harrison; John S. Spencer, 1640 The Strand, Reno, Nev., by Ned K. Johnson; Alfred R. Twiss, M.D., 2359 Gails Ave., Chehalis, Wash., by Kenneth E. Stager; William G. Conway, St. Louis Zoo, Forest Park, St. Louis 10, Mo., Abram Lawrence Dean, 911 Preston Ave., Blacksburg, Va., Dr. Gerald M. Hunt, 3911 Alicia Dr., San Diego 7, Calif., John C. Johnson, Jr., Dept. Zoology, Univ. Oklahoma, Norman, Okla., Kenneth Frederick Edwards, M.D., 169 Hillendale Ave., Bath Rd. P. O., Kingston, Ontario, Canada, J. D. French, M.D., Veterans Admin. Hospital, Long Beach 4, Calif., Wesley Edwin Lanyon, Dept. Zoology, Univ. Wisconsin, Madison, Wis., John R. Nevius, Jr., 1847 W. 68th St., Los Angeles 47, Calif., Charles L. Overshiner, 5321 Mt. Helena Ave., Los Angeles 41, Calif., Mrs. Dan Siemens, 5179½ Village Green, Los Angeles 16, Calif., South G. Van Hoose, Museum of Natural History, University of Kansas, Lawrence, Kans., Austin L. Rand, Chicago Museum Nat Hist., Roosevelt Rd. and Grant Park, Chicago 5, Ill., Jeff Swinebroad, Dept. Zoology and Entomology, Ohio State University, Columbus, Ohio, Joseph R. Werning, 105–D Martin Lane, Monroe Park, Wilmington 6, Del., Dr. Harold Gifford, 363b Burt St., Ohama 3, Nebr., and Elmer George Worthley, Bonita Ave., Owings Mills, Md., all by C. V. Duff.

Report of the Nominating Committee was given by C. V. Duff. Officers of the Southern Division for 1955 were elected as follows: Jack C. von Bloeker, Jr., president; Thomas R. Howell, first vice-president; Robert L. Taylor, second vice-president; and Dorothy E. Groner, secretary.

John H. Baumgardt reported that on May 6, 1954, he had observed a goshawk nesting in northern Inyo County. The nest which contained 4 eggs was located 40 feet up in a yellow pine overlooking a small lake at 10,000 feet elevation. On May 8, he observed a small colony of Common and Snowy egrets located 10 miles south of Bishop on a small dry lake that had been flooded by recent rains. Eleven nests were examined, five of which were those of Snowy Egrets.

Jean Delacour presented material from his new book, volume 1 of "The Waterfowl of the World"; in addition, he showed a motion picture of Cleres Park, his estate and wildfowl collection in France.—DOROTHY E. GRONER, *Secretary*.

For Sale, Exchange, and Want Column—**Each member of the Cooper Society is entitled to one short advertising notice in any issue of the Condor free. Notices of over 3 lines will be charged for at the rate of 25 cents per line. Send advertising copy to Jack C. von Bloeker, Jr., 161 West 121st St., Los Angeles 61, California.**

FOR SALE—Finding Birds in Mexico, a new guide, by Ernest P. Edwards, featuring detailed notes on 56 localities in Mexico, with local bird lists, and directions to birding areas, habitat directories, camp sites, tourist accommodations, etc.; approx. 100 pp., with illustrations of important features of more than 70 exotic species; paper cover, $1.90 postpaid from publisher.—E. P. EDWARDS & Co., *Box 611, Amherst, Va.*

WANTED—To purchase a complete collection of bird's eggs with cabinet for college use.—A. L. DEAN, *911 Preston Ave., Blacksburg, Va.*

FOR SALE—Complete files of Bulletin of the Nuttall Ornithological Club, vols. 1–8, and The Auk, vols. 1–71; vols. 1–18 of The Auk nicely bound, remainder unbound but in fine condition. Inquiries invited from interested buyers; proceeds to be deposited in the Endowment Fund of the Cooper Ornithological Society.—C. V. DUFF, *Business Manager, 1922 Tamarind Ave., Hollywood 28, Calif.*

FOR SALE—One copy of A. O. U. Check-list of N. A. Birds, 1931 (4th Ed.), including set of supplements since 1931, perfect condition, $15.00.—CHARLES G. SIBLEY, *Dept. Conservation, Cornell University, Ithaca, N.Y.*

WANTED—A Distributional Survey of the Birds of Sonora, Mexico, by A. J. van Rossem; please state price and condition.—DON R. MEDINA, *The Moore Zoological Laboratory, Occidental College, Los Angeles 41, Calif.*

FOR SALE—Birds of the Northwest, Coues, bound, $4.50; Biological Investigations in Mexico, Goldman, $3.50; Mammals of New Mexico, Bailey, $10.00; Concealing Coloration in Birds and Mammals, Roosevelt, $4.50.—H. H. T. JACKSON, *U. S. National Museum, Washington 25, D.C.*

INFORMATION ON BINOCULARS—For a simplified way to check the alignment of a binocular send for reprint of our article "Alignment" published in Jan. 1954 Audubon Magazine. It supplements our booklet "Know Your Binoculars," reprinting our earlier Audubon Magazine articles on how to choose the model best for your purpose and how to use it most advantageously; fully illustrated, 10¢. Both reprints free to members of Cooper Ornithological Society—write for your copies now. If your binocular is not functioning perfectly, send it to us for free collimator check and repair estimate. If you need a new one, send for our list of complete lines of Bausch and Lomb, German, and Japanese binoculars and 'scopes. All instruments guaranteed adjusted to U. S. Government specifications, and sent on 20 days' trial. We answer questions personally; if you have a binocular problem, let us help you solve it.—THE REICHERTS, *Mirakel Repair Co., Mount Vernon 15, N.Y.*

FOR SALE—H. W. Elliott, A Monograph of the Seal Islands of Alaska, U. S. Comm. of Fish & Fisheries, Washington, 1882, wrappers; D. S. Jordan, The Fur-seal Islands of the North Pacific Ocean, pts. 1–4, Washington, 1898, 4 vols. bound.—ROBERT A. MCCABE, *Dept. Wildlife Management, University Wisconsin, Madison 6, Wis.*

FOR SALE—The Auk, vols. 24–57 (1907–1940), 34 volumes, separate numbers in original covers, in excellent condition; price $34.00 plus bookpost or express charges.—FRANK A. PITELKA, *Museum of Vertebrate Zoology, Berkeley 4, California.*

MUSIC IN NATURE

By LOYE MILLER

Four 12-inch, vinylite (non-breakable) phonograph records with over 50 bird songs and animal sounds.

This popular talk by Loye Miller is again available. Music in Nature is an informal discussion of the five elements of music—time, tone, tune, timbre, touch—in relationship to bird songs and animal sounds. These sounds are reproduced by Professor Miller's own vocal and whistled imitations. Highlights are the four calls of the California Quail, the songs and cries of the goldfinch, wolf, horned owl, tree-toad, and meadowlark, and the amazing combination of tongue flutter, whistle, and grunt used to reproduce the sound of the Sandhill Crane. Fifty of the bird songs and animal sounds are applicable in any state of the Union. This material is ideally suited for all grades of classroom instruction and is being used by many school districts throughout the country.

Loye Miller has made field studies of natural sounds for more than fifty years. As Professor of Biology in the University of California at Los Angeles, he has long been noted as a scientist and teacher and for his leadership in nature study groups and for his talks about birds and animals.

The University of California has given The Cooper Ornithological Society the right to sell Music in Nature as a contribution to Ornithology.

The four discs, seven sides recorded, $7.50 plus 3% state sales tax in California.

Send your order with check payable to

THE COOPER ORNITHOLOGICAL SOCIETY

% Department of Zoology, University of California, Los Angeles 24, California.